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In reply, please refer to:
File:

01004PKP.20c
DATE: January 20, 2020
NPDES PERMIT NO. HI 0021296

FACT SHEET: APPLICATION FOR RENEWAL OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND ZONE OF MIXING (ZOM) TO DISCHARGE TO THE PACIFIC OCEAN, WATERS OF THE UNITED STATES

PERMITTEE: CITY AND COUNTY OF HONOLULU DEPARTMENT OF ENVIRONMENTAL SERVICES

FACILITY: KAILUA REGIONAL WASTEWATER TREATMENT PLANT (WWTP)

FACILITY MAILING ADDRESS
City and County of Honolulu
Kailua Regional WWTP
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Kailua, Hawaii 96734
Contact: Harry K. Hauck III
Wastewater Plant
District Supervisor
Phone No: (808) 768-5969

PERMITTEE MAILING ADDRESS
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Kapolei, Hawaii 96707
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Department of Environmental
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City and County of Honolulu
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FACILITY STREET ADDRESS
Kailua Regional WWTP
95 Kaneohe Bay Drive
Kailua, Hawaii 96734

Table of Contents

This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of the draft permit.

A. Permit Information

The following table summarizes administrative information related to the Kailua Regional Wastewater Treatment Plant (hereinafter, facility).

Table F-1. Facility Information

Permittee	City and County of Honolulu
Name of Facility	Kailua Regional Wastewater Treatment Plant
Facility Address	95 Kaneohe Bay Drive Kailua, Hawaii 96734
Facility Contact, Title, and Phone	Harry K. Hauck III, Wastewater Plant District Supervisor, (808) 768-5969
Authorized Person to Sign and Submit Reports	Lori M.K. Kahikina, Director, (808) 768-3486
Mailing Address	1000 Uluohia Street, Suite 308 Kapolei, Hawaii 96707
Billing Address	Same as mailing address
Type of Facility	Wastewater Treatment Plant
Industrial Storm Water	Yes - regulated by NPDES Permit No. HIS000002
Pretreatment Program	Yes
Recycling Requirements	Not Applicable
Facility Design Flow	15.25 million gallons per day (MGD)
Receiving Waters	Pacific Ocean
Receiving Water Type	Marine
Receiving Water Classification	Class A Dry Open Coastal Waters (HAR, Section 11-54-06(b)(2)(B))

1. NPDES Permit No. HI 0021296, including Zone of Mixing (ZOM), for the Kailua Regional Wastewater Treatment Plant ("Kailua Regional WWTP" or "facility") became effective on September 2, 2006, and expired on June 30, 2009 ("Prior Permit"). The Permittee reapplied for NPDES Permit No. HI 0021296, including the ZOM, on December 16, 2008. The renewal permit became effective on March 16, 2014 and expired on February 13, 2019. Since its issuance, the 2014 Permit underwent a minor modification on October 27, 2014, and major modifications on September 10, 2015, and June 19, 2017 ("2014 Permit"). The Permittee reapplied for an NPDES permit on August 10, 2018. The Hawaii Department of Health (hereinafter DOH) administratively extended the 2014 Permit, including the ZOM, on February 12, 2019, pending the reapplication processing.

2. On March 14, 2014, the Permittee sent a request for a contested case hearing (Docket No. 14-CWB-EMD-2) objecting to several conditions of the 2014 Permit

and requesting that those conditions be stayed during the pendency of the proceedings (“Contested Case Proceeding”). In the Contested Case Proceeding, the DOH and the Permittee entered into several stipulated orders to stay certain permit conditions until a final decision was made in the Contested Case Hearing, the most recent being a Seventh Stipulation which was approved by the Hearings Officer on March 13, 2017 (“Seventh Stipulation”).

3. The DOH proposes to issue a permit to discharge to the waters of the state until **<DATE>**, and has included in the draft permit those terms and conditions which are necessary to carry out the provisions of the Federal Water Pollution Control Act (P.L. 92-500), Federal Clean Water Act (CWA) (P.L. 95-217) and Chapter 342D, Hawaii Revised Statutes.

B. Facility Setting

1. Facility Operation and Location

The Permittee owns and operates the facility, located in Kailua, Hawaii, on the Island of Oahu. The facility has a design capacity of 15.25 MGD and provides secondary treatment of wastewater for approximately 94,000 in the communities of Ahuimanu, Kaneohe, and Kailua.

The service area has two preliminary treatment facilities: Ahuimanu and Kaneohe. Wastewater from the Ahuimanu area goes through preliminary treatment at the Ahuimanu Preliminary Treatment Facility (PTF) and is conveyed via forcemain to the intersection of Haiku Rd and Kahekili Hwy where it then flows by gravity to Kaneohe PTF. Wastewater generated in the Kaneohe area is preliminary treated at the Kaneohe PTF prior to being conveyed to the Kailua Regional WWTP. Additionally, wastewater generated in the Kailua area is gravity-fed to the Kailua Regional WWTP.

Influent enters the facility through two (2) main lines, a gravity tunnel from the Kaneohe PTF and a gravity main from Kailua. Flows from the Kaneohe PTF comingle with wastewater generated from the Kailua area in a rectangular concrete channel. Treatment consists of three (3) mechanical fine bar screens, two (2) grit removal systems, four (4) primary clarifiers, two (2) biotowers, two (2) aerated solids contact tanks, and three (3) secondary clarifiers.

Treated effluent is discharged through a Parshall flume and then comingles with treated effluent from the Kaneohe Marine Corps Base. Mixed effluent is conveyed by forcemain to the discharge point and then is discharged to the Pacific Ocean off of the Mokapu Peninsula through Outfall Serial No. 001 (Mokapu Outfall) at Latitude 21°27’32” N and Longitude 157°42’56” W.

Outfall Serial No. 001 is a 48-inch diameter, deep ocean outfall that discharges treated effluent approximately 105 feet below the surface of the water. The outfall pipeline extends 4,072 feet from the onshore cleanout chamber to the start of the diffuser. The diffuser, which begins approximately 3,500 feet from shore is approximately 960 feet long and consists of a 48-inch diameter pipe with 80 side ports along the pipe sidewalls that range in size from 4 inches to 5.5 inches in diameter and two end ports, one with a 4-inch diameter and one with a 5.5-inch diameter.

Sludge processing consists of two (2) dissolved air flotation thickeners, four (4) anaerobic digestors, and three (3) centrifuges for further solids processing. Solids are hauled to H-Power for waste to energy conversion and is only disposed of in a landfill when H-Power is not available.

Storm water from the facility is subject to regulation under the City and County of Honolulu's municipal separate storm sewer (MS4) permit (NPDES Permit No. HI S000002).

Figure 1 of the draft permit provides a map showing the location of the facility. Figure 2 of the draft permit provides a map of the ZOM, Zone of Initial Dilution (ZID), and receiving water monitoring locations.

2. Receiving Water Classification

The Pacific Ocean off the Mokapu Peninsula is designated as a "Class A Dry Open Coastal Waters" under Hawaii Administrative Rule (HAR), 11-54-06(b)(2)(B). Protected beneficial uses of Class A waters include recreation, aesthetic enjoyment, and the protection and propagation of fish, shellfish, and wildlife.

3. Ocean Discharge Criteria

The DOH has considered the Ocean Discharge Criteria, established pursuant to Section 403(c) of the CWA for the discharge of pollutants into the territorial sea, the waters of the contiguous zone, or the oceans. The United States Environmental Protection Agency (EPA) has promulgated regulations for Ocean Discharge Criteria in 40 Code of Federal Regulations (CFR) 125, Subpart M. The Director has determined that the discharge will not cause unreasonable degradation to the marine environment. Based on current information, the DOH proposes to issue the draft permit.

4. Impaired Water Bodies on CWA 303(d) List

CWA Section 303(d) requires states to identify specific water bodies where water quality standards (WQSs) are not expected to be met after implementation of technology-based effluent limitations on point sources.

On August 16, 2018, the EPA approved the 2018 State of Hawaii Water Quality Monitoring and Assessment Report, which includes the 2018 303(d) List of Impaired Water Bodies in the State of Hawaii.

The report does not specifically identify the Pacific Ocean off of Mokapu Peninsula on the 2018 303(d) list. The closest listing to Outfall Serial No. 001 is Fort Hase Beach. Fort Hase Beach is not listed as an impaired waterbody for any pollutants on the 2018 303(d) list and is reported as a Category 2 and 3 waterbody. Currently, no Total Maximum Daily Loads (TMDLs) have been established for this waterbody.

5. Summary of Existing Effluent Limitations

a. Existing Effluent Limitations and Monitoring Data

Effluent limitations contained in the 2014 Permit for discharges from Outfall Serial No. 001 and representative monitoring data from March 2014 through December 2018, are presented in the following tables.

Table F-2. Existing Effluent Limitations and Monitoring Data – Outfall Serial No. 001

Parameter	Units	Effluent Limitation			Reported Data[1]		
		Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily
Flow	MGD	[2]	[2]	[2]	16.3	20.8	36.6
Biochemical Oxygen Demand (5-Day @ 20 Deg. C) (BOD_5)	mg/L	30	45	[2]	27.7	40.2	52
	lbs/day	3,816	5,723	[2]	2,505	4,626	8,901
	% Removal	The average monthly percent removal shall not be less than 85 percent			82[3]		
Total Suspended Solids (TSS)	mg/L	30	45	[2]	19.9	30.5	66
	lbs/day	3,816	5,723	[2]	2,421	5,459	14,537
	% Removal	The average monthly percent removal shall not be less than 85 percent			89[3]		

1 Source: Monthly Discharge Monitoring Reports (DMRs) and daily data submitted by the Permittee from March 2014 through December 2018. This data represents the highest reported value over the monitoring period specified.
2 No effluent limitations set in the 2014 Permit, only monitoring required.
3 Data represent minimum percent removal reported.

Table F-3. Existing Effluent Limitations and Monitoring Data – Outfall Serial No. 001

Parameter	Units	Effluent Limitation			Reported Data[1]		
		Average Annual	Average Monthly	Maximum Daily	Average Annual	Average Monthly	Maximum Daily
pH	standard units	Not less than 6.0 nor greater than 9.0			6.5 – 7.5		
Oil and Grease	mg/L	--	--	[2]	--	--	14.8
	lbs/day	--	--	[2]	--	--	1,667
Chronic Toxicity *Tripneustes gratilla*	Pass/Fail	--	--	Pass	--	--	Fail[3]
Enterococci	CFU/100 mL	--	[4]	[4]	--	43,388	190,000
Temperature	°C	--	--	[2]	--	--	31
Total Nitrogen	µg/L	--	--	[2]	--	--	32,150
	lbs/day	--	--	[2]	--	--	2,780
Total Phosphorus	µg/L	--	--	[2]	--	--	3,900
	lbs/day	--	--	[2]	--	--	368
Ammonia Nitrogen	µg/L	--	--	[4]	--	--	15,500
	lbs/day	--	--	[4]	--	--	1,799
Nitrate + Nitrite Nitrogen	µg/L	--	--	[4]	--	--	11,040
	lbs/day	--	--	[4]	--	--	1,138
Turbidity	NTU	--	--	[2]	--	--	20
Chlordane	µg/L	[4]	--	[4]	0.0616[5]	--	0.127[5]
	lbs/day	[4]	--	[4]	0.0073[5]	--	0.021[5]
Dieldrin	µg/L	[4]	--	[4]	0.0483[5]	--	0.088[5]
	lbs/day	[4]	--	[4]	0.0073[5]	--	0.021[5]

1 Source: Highest reported values from monthly DMRs submitted by the Permittee from March 2014 through December 2018.
2 No effluent limitations for this pollutant in the 2014 Permit, only monitoring required.
3 Chronic toxicity tests for the Permittee are reported as “Pass” or “Fail” as discussed in Part C.2.h of this Fact Sheet. During the previous permit term, the Permittee reported 64 results as “Pass’ and four (4) results as “Fail”.
4 Effluent limitations in the 2014 Permit were challenged and stayed in the Contested Case Proceeding, and no limits were contained in the Prior Permit. *See* EPA’s Interim Guidance on Implementation of Section 402(o) Anti-backsliding Rules for Water Quality-Based Permits
5 Calculated using monthly DMR data submitted by the Permittee from March 2014 through December 2018.

6. Compliance Summary

The following table lists effluent limitation violations as identified in monthly and annual DMRs, in addition to the permit renewal application submitted by the Permittee, from March 2014 to December 2018.

Table F-4. Summary of Compliance History

Monitoring Period	Violation Type	Pollutant	Reported Value	Effluent Limitation	Units
3/1/14 – 3/31/14	% Removal	BOD_5	83	Not less than 85	%
5/1/14 – 5/31/14	% Removal	BOD_5	84	Not less than 85	%
6/1/14 – 6/30/14	% Removal	BOD_5	84	Not less than 85	%
12/1/14 – 12/31/14	Maximum Daily	Chronic Toxicity	Fail	Pass	Pass/Fail
8/1/16 – 8/31/16	Maximum Daily	Chronic Toxicity	Fail	Pass	Pass/Fail
9/1/16 – 9/30/16	Maximum Daily	Chronic Toxicity	Fail	Pass	Pass/Fail
10/1/16 – 10/31/16	% Removal	BOD_5	82	Not less than 85	%
11/1/16 – 11/30/16	% Removal	BOD_5	83	Not less than 85	%
12/1/16 – 12/31/16	% Removal	BOD_5	84	Not less than 85	%
1/1/18 – 1/31/18	Maximum Daily	Chronic Toxicity	Fail	Pass	Pass/Fail
2/1/18 – 2/28/18	% Removal	BOD_5	83	Not less than 85	%
4/1/18 – 4/30/18	% Removal	BOD_5	84	Not less than 85	%

a. Inspections Conducted

The DOH, with PG Environmental, conducted Compliance Evaluation Inspections (CEIs) of the facility on February 2, 2016, November 15, 2017, and November 18, 2019. A summary of the latest inspection is not yet available. Summaries of observations from the previous inspections are listed below. The Permittee received reports from the February 2, 2016 and November 15, 2017 inspections, on June 13, 2016 and February 3, 2018, respectively. The Permittee provided a response to the November 15, 2017 CEI on April 16, 2018. Below is a summary of observations made during the inspections as well as the Permittee's response to findings included in the November 15, 2017, CEI.

- 2016 and 2017 Inspection Summary:
  - Multiple examples of deficiencies in operation and maintenance of the existing wastewater treatment units were noted during the inspections. Physical deficiencies included a lack of adequate screening and grit removal within the plant's headworks, accumulation of floatables within the primary clarifiers, questionable function of the secondary treatment units, inoperability of the solids contactors and evidence of ineffective secondary clarification. Operational deficiencies included a lack of preventative and corrective maintenance and lack of a complete and updated asset management system to track the

performance and maintenance requirements of its treatment units and appurtenances.

- The deficiencies noted above were recorded over the inspections conducted during 2016 and 2017 and correlate with the Facility's poor performance with respect to B.O.D. removal between late 2016 and early 2018.

- Documented Upgrades to the Facility:

  - The inspection reports document that the facility was in the process of major treatment unit upgrades. Upgrades to the treatment units included major improvements to the facility's collection system (KK Tunnel project), construction of an all new headworks unit, installation of a new odor control system, repair and/or replacement of pumps for effluent treatment and solids handling, and overhauling of treatment units that were out of service (e.g. solids contactor).

- Permittee's Response to Inspection Findings:

  - The Permittee provided a tabular response to the inspection report resulting from the November 15, 2017, CEI. The Permittee's responses included an itemized reconciliation of corrective actions made to address the major operation and maintenance deficiencies noted in the inspections. The response included either specific dates or timely estimates for corrections to primary (e.g. primary clarifiers) and secondary treatment units (e.g. biotowers, solids contactors,etc.), solids handing equipment and pumps.

  - All of the corrections listed in the Permittee's response included completion dates no later than mid-2018.

- Corrective actions, upgrades, repair and improvements to treatment units documented in the inspection reports and Permittee's response are expected to improve treatment efficiency and stabilize effluent quality.

b. Facility Incidents

(1) Reported Spills

The Discharger reported approximately 21 spills from April 2014 until May 2018.

c. Enforcement Actions

(1) Written Notice of Apparent Violation (NAV)

(a) On November 17, 2014, the Permittee received a NAV from DOH notifying them of an apparent violation of the terms of the Permittee’s NPDES permit, which were noted during a CEI. After a follow-up CEI in the first quarter of 2015, the NAV was closed.

(b) On November 26, 2014, the Permittee received a NAV from DOH notifying them of an apparent violation of the pretreatment requirements in their NPDES permit, which were noted during a Pretreatment Compliance Audit. After a follow-up Pretreatment Compliance Audit in the first quarter of 2015, the NAV was closed.

(2) Administrative Order on Consent (AOC)

(a) On January 12, 2017 DOH and the City and County of Honolulu voluntarily entered into an AOC to take specific corrective actions to reduce and avoid unauthorized discharges of pollutants to waters of the State. Under the AOC, the City agreed to conduct a High Density Urban Area Storm Water Inflow Detection, Identification and Quantification Study, revise Standard Operating Procedures (SOPs) to improve response to spill prevention alarms, upgrade the City Sewage System SCADA System, and revise sewage spill volume estimate procedure.

7. Planned Changes

There are no planned changes during the term of this proposed permit.

C. Applicable Plans, Policies, and Regulations

1. Hawaii Administrative Rules, Chapter 11-54

On November 12, 1982, the Hawaii Administrative Rules, Title 11, Department of Health, Chapter 54 became effective (hereinafter HAR, Chapter 11-54). HAR, Chapter 11-54 was amended and compiled on October 6, 1984; April 14, 1988; January 18, 1990; October 29, 1992; April 17, 2000; October 2, 2004; June 15, 2009; October 21, 2012; December 6, 2013; and the most recent amendment was on November 15, 2014. HAR, Chapter 11-54 establishes beneficial uses and classifications of state waters, the state antidegradation policy, zones of mixing standards, and water quality criteria that are applicable to the Pacific Ocean off of Mokapu Peninsula.

Requirements of the draft permit implement HAR, Chapter 11-54.

2. Hawaii Administrative Rules, Chapter 11-55

On November 27, 1981 HAR, Title 11, Department of Health, Chapter 55 became effective (hereinafter HAR, Chapter 11-55). HAR, Chapter 11-55 was amended and compiled on October 29, 1992; September 22, 1997; January 6, 2001; November 7, 2002; August 1, 2005; October 22, 2007; June 15, 2009; October 21, 2012; December 6, 2013; November 15, 2014; July 13, 2018; and the most recent amendment was on February 2, 2019. HAR, Chapter 11-55, establishes standard permit conditions and requirements for NPDES permits issued in Hawaii.

Requirements of the draft permit implement HAR, Chapter 11-55.

3. State Toxics Control Program

NPDES Regulations at 40 CFR 122.44(d) require permits to include water quality-based effluent limitations (WQBELs) for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a WQS. The *State Toxics Control Program: Derivation of Water Quality-Based Discharge Toxicity Limits for Biomonitoring and Specific Pollutants* (hereinafter, STCP) was finalized in April 1989, and provides guidance for the development of water quality-based toxicity control in NPDES permits by developing the procedures for translating WQSs in HAR, Chapter 11-54 into enforceable NPDES permit limitations. The STCP identifies procedures for calculating permit limitations for specific toxic pollutants for the protection of aquatic life and human health.

Guidance contained in the STCP was used to determine effluent limitations in the draft permit.

D. Rationale for Effluent Limitations and Discharge Specifications

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. NPDES regulations establish two principal bases for effluent limitations. At 40 CFR 122.44(a), permits are required to include applicable technology-based limitations and standards; and at 40 CFR 122.44(d), permits are required to include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. When numeric water quality objectives have not been established, but a discharge has the reasonable potential to cause or contribute to an excursion above a narrative criterion, WQBELs may be established using one or more of three methods described at 40 CFR 122.44(d) – 1) WQBELs may be established using a calculated water quality criterion derived from a proposed state criterion or an explicit state policy or regulation interpreting its narrative criterion; 2) WQBELs may be established on a case-by-case basis using EPA criteria guidance published under CWA Section 304(a); or 3) WQBELs may be established using an indicator parameter for the pollutant of concern.

1. Technology-Based Effluent Limitations

a. Scope and Authority

Section 301(b) of the CWA and 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this draft permit must meet minimum federal technology-based requirements based on Secondary Treatment Standards at 40 CFR 133.

Regulations promulgated in 40 CFR 125.3(a)(1) require technology-based effluent limitations for municipal Permittees to be placed in NPDES permits based on Secondary Treatment Standards or Equivalent to Secondary Treatment Standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for publicly owned treatment works (POTWs) [defined in section 304(d)(1)]. CWA Section 301(b)(1)(B) requires that such treatment works must, at a minimum, meet effluent limitations based on secondary treatment as defined by the EPA Administrator.

Based on this statutory requirement, EPA developed secondary treatment regulations, which are specified in 40 CFR 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

b. Applicable Technology-Based Effluent Limitations

At 40 CFR 133 in the Secondary Treatment Regulations, EPA has established the minimum required level of effluent quality attainable by secondary treatment shown in Table F-5 below. The standards in Table F-5 are applicable to the facility and therefore established in the draft permit as technology-based effluent limitations.

Table F-5. Applicable Technology-Based Effluent Limitations

Parameter	Units	30-Day Average	7-Day Average
BOD_5[1]	mg/L	30	45
TSS[1]	mg/L	30	45
pH	standard units	6.0 – 9.0	

[1] The 30-day average percent removal shall not be less than 85 percent.

2. Water Quality-Based Effluent Limitations (WQBELs)

a. Scope and Authority

NPDES regulations at 40 CFR 122.44(d) require permits to include WQBELs for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a WQS, including numeric and narrative objectives within a standard (reasonable potential). As specified in 40 CFR 122.44(d)(1)(i), permits are required to include WQBELs for all pollutants "which the Director determines are or may be discharged at a level that will cause, have reasonable potential to cause, or contribute to an excursion above any state water quality standard."

The process for determining reasonable potential and calculating WQBELs, when necessary, is intended to protect the receiving waters as specified in HAR, Chapter 11-54. When WQBELs are necessary to protect the receiving waters, DOH has followed the requirements of HAR, Chapter 11-54, the STCP, and other applicable State and federal guidance policies to determine WQBELs in the draft permit.

Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established in accordance with the requirements of 40 CFR 122.44(d)(1)(vi), using (1) EPA criteria guidance under CWA Section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information.

b. Applicable Water Quality Standards

The beneficial uses and WQSs that apply to the receiving waters for this discharge are from HAR, Chapter 11-54.

(1) Basic Water Quality Criteria Applicable to All Waters. HAR, 11-54-4(c)(3) specifies numeric aquatic life standards for 72 toxic pollutants and human health standards for 61 toxic pollutants, as well as narrative standards for toxicity. Effluent limitations and provisions in the draft permit are based on available information to implement these standards.

(a) Saltwater Standards. The facility discharges to the Pacific Ocean, which is classified as a marine Class A Dry Open Coastal Water in HAR, Chapter 11-54. As specified in HAR, Chapter 11-54, saltwater standards apply when the dissolved inorganic ion concentration is above 0.5 ppt. As such, a reasonable potential analysis (RPA) was conducted using saltwater standards.

(b) Human Health Standards. Additionally, fish consumption water quality standards were also used in the RPA to protect human health. Where both saltwater standards and human health standards are available for a particular pollutant, the more stringent was used in the RPA.

(c) Total Recoverable Metals. 40 CFR 122.45(c) requires effluent limitations for metals to be expressed as total recoverable metal. Since water quality standards for metals are expressed in the dissolved form in HAR, Chapter 11-54, factors or translators must be used to convert metal concentrations from dissolved to total recoverable. Default EPA conversion factors were used to convert the applicable dissolved criteria to total recoverable.

(d) Receiving Water Hardness. HAR, Chapter 11-54 contains water quality criteria for six metals that vary as a function of hardness in freshwater. A lower hardness results in a lower freshwater WQS. The metals with hardness dependent standards include cadmium, copper, lead, nickel, silver, and zinc. Ambient hardness values are used to calculate freshwater WQSs that are hardness dependent. Since saltwater standards are used for the RPA, the receiving water hardness was not taken into consideration when determining reasonable potential.

(2) Specific Water Quality Criteria for the Pacific Ocean. HAR, 11-54-6(b)(3) specifies water quality criteria for nutrients, pH, dissolved oxygen, temperature and salinity for the Pacific Ocean. Criteria for nutrients are classified as "not to exceed the given value more than two per cent of the time," "not to exceed the given value more than ten percent of the time" and "geometric mean not to exceed the given value." Other parameters include acceptable ranges based on the ambient values.

c. Determining the Need for WQBELs

NPDES regulations at 40 CFR 122.44(d) require effluent limitations to control all pollutants which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State WQS. Assessing whether a pollutant has reasonable potential is the fundamental step in determining if a WQBEL is required.

(1) Reasonable Potential Analysis (RPA)

Toxic Pollutants. Using the methods described in EPA's *Technical Support Document for Water Quality-Based Toxics Control* (the TSD, EPA/505/2-90-001, 1991), the effluent data for Permittee's toxic pollutants from Outfall Serial No. 001 were analyzed to determine if the discharge demonstrates reasonable potential to exceed the applicable WQS. The RPA for pollutants with WQS specified in HAR, Section 11-54-4, based on the TSD, combines knowledge of effluent variability as estimated by a coefficient of variation with the uncertainty due to a limited number of data to project an estimated maximum receiving water concentration as a result of the effluent. The estimated receiving water concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level. The projected maximum receiving water concentration, after consideration of dilution, is then compared to the most stringent applicable WQS in HAR, Chapter 11-54, to determine if the pollutant has reasonable potential. The projected maximum receiving water concentration has reasonable potential if it cannot be demonstrated with a high confidence level that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water standards.

The projected maximum receiving water concentration for non-carcinogens is calculated using the following equation:

Maximum RWC = (Multiplier * X_{Max}) / (D)

Where:

Maximum RWC	=	Receiving water concentration
Multiplier	=	Multiplier calculated using methods in Section 3.3.2 of the TSD (99% multiplier for municipal facilities and 95% multiplier for industrial facilities)
X_{Max}	=	Highest observed pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The initial dilution at the ZID is used as D for determining reasonable potential for non-carcinogens.

The projected maximum receiving water concentration for carcinogens is calculated using the following equation:

Maximum RWC = X_{Max}/(D)

Where:

Maximum ARWC	=	Maximum annual average receiving water concentration
AX_{Max}	=	Highest observed annual average pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The average dilution at the ZID is used as D for determining reasonable potential for carcinogens.

Due to the long exposure time associated with human health criteria for carcinogens (e.g., 70 years), and because the human health criteria for carcinogens is expressed as an annual average, the RPA for carcinogens was performed based on an observed maximum annual average value compared to the applicable criteria. The use of the maximum annual average assumes an exposure period that is much shorter than the period of exposure for the criteria and is reasonable to assume will be greater than the long-term average over the period of exposure for the criteria. As such, the use of an annual average in evaluating reasonable potential for the most stringent criteria for carcinogens is protective of water quality.

The RPA followed the guidance set forth by the EPA through its EPA Region 10 Guidance for WQBELs Below Analytical Detection/Quantitation Level, EPA, 1996 in its treatment of data that is detected at limits below the Minimum Level (i.e., the level at which the parameter may be accurately quantified) or the Detection Limit. Where the maximum annual average concentration is greater than the applicable WQS from HAR, Chapter 11-54, then reasonable potential exists for the pollutant, and effluent limitations are established.

Nutrients. For nutrients, the most stringent WQS specified in HAR, Section 11-54-6, are provided as geometric means and exceedances of these WQS are less sensitive to effluent variability. The RPA was conducted by directly comparing the maximum annual geometric mean of receiving water data at the edge of the ZOM to the applicable geometric mean listed in HAR, Section 11-54-6.

(2) Effluent Data. The RPA for toxic pollutants was based on effluent monitoring data submitted to DOH in DMRs from March 2014 to December 2018 and with the permit application. The RPA for nutrients was based on receiving water effluent data submitted to DOH in DMRs from March 2014 to December 2018.

(3) Dilution. The STCP discusses dilution, defined as the reduction in the concentration of a pollutant or discharge which results from mixing with the receiving waters, for submerged and high-rate outfalls. The STCP states that minimum dilution is used for establishing effluent limitations based on chronic criteria and human health standards for non-carcinogens, and average conditions are used for establishing effluent limitations based on human health standards for carcinogens.

The 2014 Permit included a minimum initial dilution of 185:1 (seawater: effluent) for effluent limitations based on a 1985 dilution study conducted by a contractor (TetraTech, Inc.) for EPA’s 301(h) application review using EPA’s mathematical model, PLUME.

On March 16, 2017, the Permittee submitted an updated dilution study for the facility using NRFIELD, the latest version of the Visual Plumes model for dilution calculations (“2017 Kailua Dilution Study”, “Appendix 1”). The model evaluated the minimum dilution and average dilution in the initial mixing zone where jet and buoyant near field processes occur, as well as the far field dilution (with and without bacterial decay processes) using the most appropriate available data.

For initial mixing, the model considered more recent ambient and effluent data and model input values that accurately reflect current operating and environmental conditions, including:

- Ocean current measurements recorded from five (5) current meters at approximately mid-depth deployed from September 30, 1989 through October 30, 1989;
- Quarterly ambient conductivity, temperature, depth profiler (CTD) data from 2012 through 2016;
- Effluent temperature and salinity data; and
- Peak 3-hour flow rate data obtained by applying a moving average to the data from January 2016 through March 2016 and the highest value extracted. Since the tributary area will experience very little growth in the next five years, the analysis assumed that the projected 3-hour peak flow of 15.7 MGD for 2021 would match those flows measured in 2016.

NRFIELD was run using profiles from six (6) monitoring stations nearest to the diffuser, collected quarterly from 2012 to 2016, a total of 120 profiles. Model runs were performed using nine (9) different currents. The facility projected 3-hour peak flow was used to model the minimum initial dilution and design flow was used to model the average initial dilution. The 10th percentile dilution factor from each current run for minimum initial dilution and geometric mean from each current run for average initial dilution were selected. The frequency of the currents was used to calculate a weighted average of each of the dilution factors.

The Permittee's 2017 Kailua Dilution Study appears to represent ambient conditions accurately. For development of this draft permit, a minimum initial dilution of 445:1 was used for chronic aquatic toxicity and fish consumption criteria for non-carcinogens and an average initial dilution of 733:1 was used for fish consumption criteria for carcinogens.

HAR, Section 11-54-9, allows the use of a ZOM to demonstrate compliance with WQS. ZOMs consider initial dilution, dispersion, and reactions from substances which may be considered to be pollutants. For HAR, Section 11-54-6 parameters, reasonable potential to contribute to an exceedance of WQS is most reasonably assessed by comparing monitoring data at the edge of the ZOM to the applicable WQS. If an annual geometric mean at the edge of a ZOM exceeds the applicable WQS, the Permittee is determined to have reasonable potential for the pollutant. If an exceedance of WQS is not observed at the edge of the

ZOM, it is assumed that sufficient dilution and assimilative capacity exists to meet WQS at the edge of the ZOM.

Assimilative capacity for pollutants with reasonable potential is evaluated for HAR, Section 11-54-6 pollutants by aggregating all control station data annually and comparing the annual geometric means to the applicable WQS. If an annual geometric mean exceeds 90 percent of the WQS, assimilative capacity is determined to be insufficient and dilution may not be granted. In order to determine whether granting dilution was appropriate, assimilative capacity was analyzed for total nitrogen, ammonia nitrogen, and total phosphorus based on background data collected at control stations M1 and M6.

(4) **Summary of RPA Results.** The maximum effluent concentrations from the DMRs and permit renewal application over the current permit term; maximum projected receiving water concentration after dilution; the applicable HAR, Sections 11-54-4(c)(3) and 11-54-6(b)(3) WQS; and results of the RPA for Permittee's pollutants discharged from Outfall Serial No. 001 are presented in Table F-6. Only pollutants detected in the discharge are presented in Table F-6. All other pollutants were not detected and therefore, no reasonable potential exists.

Data for toxic pollutants is based on semi-annual reports from 2014 through 2018. For effluent results that were reported below the method detection limit for the analytical method, zero was used for those data points when determining an annual average. The use of zero for results below the method detection limit for the purposes of an RPA is consistent with EPA Region 10's *Guidance for WQBELs Below Analytical Detection/Quantification Level*, EPA, 1996.

Reasonable potential for total nitrogen, ammonia nitrogen, and total phosphorus was evaluated using receiving water data from March 2014 through December 2018. Because the criteria for these parameters is calculated using a geometric mean, the use of zero for non-detect results, consistent with EPA Region 10 guidance, is not possible. The substitution method was utilized to account for non-detects when calculating a geometric mean. During the development of the draft permit, a substitution value of one-quarter of the method detection limit was used, which is closer to zero than previously used and consistent with the intent of the EPA guidance, but still allows for the calculation of a geometric mean. Using this revised RPA method for nutrients with the last five (5) years of data, there is no reasonable potential for total nitrogen, ammonia nitrogen, and total phosphorus.

Table F-6. Summary of RPA Results

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Antimony, Total Recoverable	µg/L	4	445:1	0.69	0.0073	15,000	No
Arsenic, Total Recoverable	µg/L	4	445:1	1.5	0.016	36	No
Beryllium, Total Recoverable	µg/L	4	733:1	0.17	0.00023	0.038	No
Chromium, Total Recoverable	µg/L	4	445:1	2.2	0.023	50.35[1]	No
Copper, Total Recoverable	µg/L	4	445:1	38	0.40	3.5	No
Cyanide, Total	µg/L	4	445:1	3.0	0.032	1.0	No
Lead, Total Recoverable	µg/L	4	445:1	0.92	0.010	5.89	No
Mercury, Total Recoverable	µg/L	4	445:1	0.050	0.00053	0.029	No
Nickel, Total Recoverable	µg/L	4	445:1	9.7	0.10	8.38	No
Sliver, Total Recoverable	µg/L	4	445:1	0.073	0.00077	2.71	No
Thallium, Total Recoverable	µg/L	4	445:1	0.070	0.00074	16.0	No
Zinc, Total Recoverable	µg/L	4	445:1	19	0.20	90.91	No
Chlordane	µg/L	24	733:1	0.059	0.000081	0.00016	No
Dieldrin	µg/L	24	733:1	0.048	0.000066	0.000025	Yes
1,4-Dichlorobenzene	µg/L	4	733:1	0.14	0.00023	660	No
Chloroform	µg/L	4	733:1	0.14	0.00019	5.1	No
Guthion	µg/L	4	445:1	0.44	0.0046	0.010	No
Phenol	µg/L	4	445:1	5.3	0.0056	170	No
Toluene	µg/L	4	445:1	0.060	0.00063	2,100	No
Ammonia Nitrogen	µg/L	240	NA	2.13[2]	2.51[3]	2.0[3]	No[4]
Total Nitrogen	µg/L	228	NA	101.3[2]	101.3[3]	110.0[3]	No
Total Phosphorus	µg/L	2	NA	7.72[2]	7.72[3]	16.0[3]	No

1 WQS expressed as Chromium VI.
2 Maximum annual geometric mean at the edge of the ZOM. The maximum annual geometric mean was calculated using data collected at monitoring stations M2 through M5.
3 Expressed as an annual geometric mean.
4 See ammonia nitrogen discussion below.

.

(5) Reasonable Potential Determination.

(a) **Constituents with Limited Data.** In some cases, reasonable potential cannot be determined because all effluent data for some parameters were reported as below the minimum detection level. The permit requires the Permittee to continue to monitor for these constituents in the effluent using analytical methods that provide the lowest available detection limitations. When additional data become available, further RPAs will be conducted to determine whether to add numeric effluent limitations to this permit or to continue monitoring.

(b) **Pollutants with No Reasonable Potential.** WQBELs are not included in this draft permit for constituents listed in HAR, Sections 11-54-4(c)(3) and 11-54-6(b)(3), that do not demonstrate reasonable potential; however, monitoring for such pollutants is still required in order to collect data for future RPAs. Pollutants with no reasonable potential consist of those identified as such in Table F-6 or any pollutant not discussed in Parts D.2.c.(5)(a) or D.2.c.(5)(c) of this Fact Sheet.

The 2014 Permit included effluent limitations for the pollutants chlordane, dieldrin, ammonia nitrogen, and nitrate plus nitrite nitrogen. The Permittee contested the effluent limitations for these pollutants and the effluent limitations were subsequently stayed by the Hearings Officer and are no longer applicable to the discharge. Since the effluent limitations were stayed, anti-backsliding regulations are satisfied.

(1) Ammonia Nitrogen

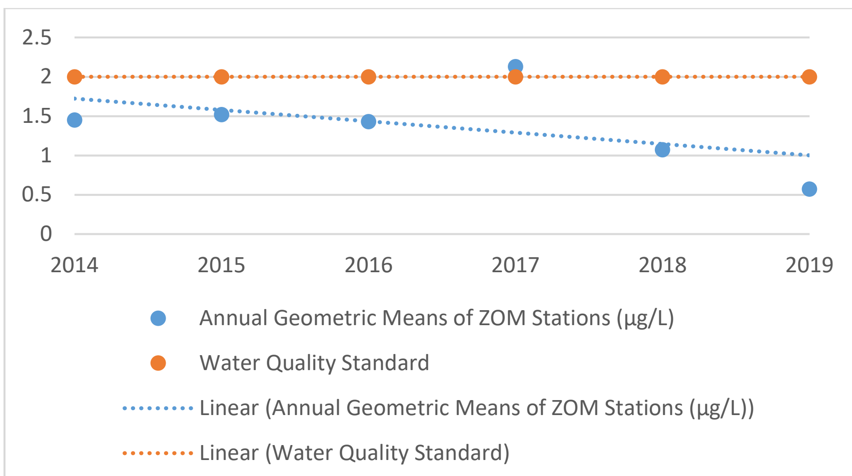
HAR, 11-54-6 establishes following WQS for ammonia nitrogen:

Parameter	Geometric Mean	Value not to exceed more than 10% of the time	Value not to exceed more than 2% of the time
Ammonia Nitrogen (µg/L)	2.00	5.00	9.00

Although the annual geometric mean for ammonia nitrogen exceeded the WQS in 2017, it can be attributed to deficiencies in operation and maintenance of the existing treatment units. The facility has since undergone several corrective actions to address the deficiencies that seems to have improved the ammonia nitrogen ZOM results in subsequent years as shown in the table below.

Year	Annual Geometric Means of ZOM Stations (µg/L)
2014	1.45
2015	1.52
2016	1.43
2017	2.13
2018	1.07
2019	0.57

In addition, the geometric means for years prior to 2017 were significantly lower than the WQS. The data from 2014 to the present shows a decreasing trend of ammonia concentrations. Based on this decreasing trend and the facility improvements to correct the plant deficiencies in 2017, it was determined that there is no reasonable potential for the facility to cause or contribute to an exceedance of ammonia nitrogen in the receiving waters.



(c) Pollutants with Reasonable Potential. The RPA indicated that dieldrin has reasonable potential to cause or contribute to an excursion of State WQS. Further, due to the nature of the discharge (secondary treated wastewater), pathogens such as enterococcus are present in the effluent. As such, reasonable potential for enterococcus has also been determined.

WQBELs have been established in the draft permit at Outfall Serial No. 001 for dieldrin and enterococcus. The RPA for each pollutant is discussed in more detail in Parts D.2.d and D.2.f. of this Fact Sheet.

The WQBELs were calculated based on WQS contained in HAR, Chapter 11-54, and procedures contained in the STCP and HAR, Chapter 11-54, as discussed in Parts D.2.d and D.2.f.

d. WQBEL Calculations

Specific pollutant limits may be calculated for both the protection of aquatic life and human health.

(1) WQBELs Based on Aquatic Life Standards. The STCP categorizes a discharge from a facility into one of four categories: (1) marine discharges through submerged outfalls; (2) discharges without submerged outfalls; (3) discharges to streams; or (4) high-rate discharges. Once a discharge has been categorized, effluent limitations for pollutants with reasonable potential can be calculated, as described below.

(a) For marine discharges through submerged outfalls, the daily maximum effluent limitation shall be the product of the chronic WQS and the minimum dilution factor;

(b) For discharges without submerged outfalls, the daily maximum effluent limitation shall be the acute toxicity standard. More stringent limits based on the chronic standards may be developed using BPJ;

(c) For discharges to streams, the effluent limitation shall be the most stringent of the acute standard and the product of the chronic standard and dilution; and

(d) For high rate outfalls, the maximum limit for a particular pollutant is equal to the product of the acute standard and the acute dilution factor determined according to Section II.B.4 of the STCP. More stringent limits based on chronic standards may be developed using BPJ.

(2) WQBELs based on Human Health Standards. The STCP specifies that the fish consumption standards are based upon the bioaccumulation of toxics in aquatic organisms followed by consumption by humans. Limits based on the fish consumption standards should be applied as 30-day averages for non-carcinogens and annual averages for carcinogens.

(3) Calculation of Pollutant-Specific WQBELs

The discharge from this facility is considered a marine discharge through a submerged outfall. Therefore, for pollutants with reasonable potential, the draft permit establishes, on a pollutant by pollutant basis, daily maximum effluent limitations based on saltwater chronic aquatic life standard after considering dilution and average monthly effluent limitations for non-carcinogens or annual average effluent limitations for carcinogens based on the human health standard after considering dilution. WQBELs established in the draft permit are discussed in detail below.

As discussed in Part D.2.c.(3) of this Fact Sheet, a minimum initial dilution of 445:1 and an average initial dilution of 733:1 have been established.

If the projected maximum receiving water concentration is greater than the applicable WQS from HAR, Chapter 11-54, then reasonable potential exists for the pollutant and effluent limitations are established. Pollutants with reasonable potential are discussed below in detail.

(a) Dieldrin

i. **Dieldrin Water Quality Standards.** The most stringent applicable WQS for dieldrin is the human health standard of 0.000025 µg/L, as specified in HAR, Chapter 11-54.

ii. **RPA Results.** The last four (4) years of data were evaluated. The highest annual average for dieldrin between March 2014 and December 2018 was 0.048 µg/L. As discussed in Part D.2.c.(3), the facility is granted an average dilution of 733:1 for human health carcinogens. Therefore, D = 733.

Projected Maximum ARWC	=	AX_{Max} / (D)
	=	0.048 µg/L / (733)
	=	0.000066 µg/L
HAR, Chapter 11-54 Water Quality Standard	=	0.000025 µg/L

The projected maximum annual average receiving water concentration (0.000066 µg/L) exceeds the most stringent applicable WQS for this pollutant (0.000025 µg/L), demonstrating reasonable potential. Therefore, the draft permit establishes effluent limitations for dieldrin.

iii. **Dieldrin WQBELs.** WQBELs for dieldrin were calculated based on the chronic aquatic life WQS and the human health standard. The draft permit establishes a daily maximum effluent limitation for dieldrin of 0.85 µg/L based on the product of the chronic aquatic life standard and the minimum dilution at the ZID (445:1). The draft permit also establishes an annual average effluent limitation for dieldrin of 0.018 µg/L based on the human health standard for carcinogens and the average dilution at the ZID (733:1).

iv. **Feasibility.** The highest daily maximum effluent concentration reported for dieldrin between March 2014 and December 2018 was 0.088 µg/L. Since the maximum effluent concentration is less than the maximum daily effluent limitation of 0.85 µg/L, DOH has determined that the facility will be able to comply with proposed maximum daily dieldrin effluent limitations.

The maximum annual average concentration reported for dieldrin during the term of the current permit is 0.0487 µg/L. Since the maximum annual average effluent concentration was greater than the annual average effluent limitation (0.018 µg/L), DOH has determined that the facility may not be able to immediately comply with the proposed annual average effluent limitation. Therefore, consistent with HAR, 11-55-21, the draft permit establishes a compliance schedule for the Permittee to comply with the final annual average effluent limitation for dieldrin no later than 10 years after the effective date of the permit. HAR, 11-55-21(b) states, “When a schedule specifies compliance longer than one year after permit issuance, the schedule of compliance shall specify interim requirements and the dates for their achievement and in no event shall more than one year elapse between interim dates. If the time necessary for completion of interim requirement (such as the construction of a treatment facility) exceeds one year and is not readily divided into stages for completion, the schedule shall specify interim dates for the submission of reports of progress towards completion of the interim requirements." The compliance schedule for dieldrin allows for funding, evaluation, design, and the execution of the construction contract, if necessary.

During the term of the compliance schedule, the Permittee is required to maintain current treatment capability. An interim average effluent limitation for dieldrin has been established until the final effluent limitation becomes effective. The interim effluent limitation has been developed based on observed effluent data over the recent permit term. The highest reported dieldrin concentration was 0.088 µg/L, and this has been established as the interim average annual effluent limitation for dieldrin in the draft permit based on current facility treatment capabilities.

As part of the compliance schedule proposed by the Permittee, the following discussion was also provided:

Background

The Kailua WWTP was built in 1965 to serve Kailua town and surrounding communities. Regional treatment was implemented in 1994, when the former treatment plants at Ahuimanu and Kaneohe were converted to preliminary treatment facilities, and the Kailua WWTP was expanded to accommodate the flows from these areas. KRWWTP receives influent from 26 pump stations and the two preliminary treatment facilities (Ahuimanu and Kaneohe).

Dieldrin is an agricultural pesticide that is no longer used but is resistant to degradation and persists in watershed soils. The probable source of dieldrin to KRWWTP is infiltration/inflow (I/I) into sewer lines from contaminated soils in the service area.

The following draft compliance plan is focused initially on preventing dieldrin from entering the sewer system; if these efforts are unsuccessful in attaining compliance with the proposed dieldrin annual average WQBEL of 0.018 ug/L, additional treatment will be evaluated and implemented.

Prevention

Initial efforts to reduce dieldrin concentrations in the effluent will focus on preventing dieldrin from entering the sewer system via I/I. A monitoring plan will be developed to evaluate dieldrin concentrations within the sewer system and help guide prevention efforts. The monitoring plan will specify sampling procedures, analytical methods, monitoring frequency, and monitoring locations. ENV personnel will use knowledge gained from I/I studies to identify the highest priority areas for initial monitoring. After development, the monitoring plan will be implemented in conjunction with existing bimonthly influent and effluent dieldrin monitoring. Sewer system monitoring will be implemented at specific locations within the system.

The primary preventative implementation activity will be through the installation of Cured In Place Pipe (CIPP) to prevent I/I. ENV personnel will collect samples within the sewer system, evaluate the data, and determine whether each section of the sewer system warrants CIPP. CIPP will be implemented where appropriate. After each CIPP installation, monitoring and data assessment will determine whether dieldrin concentrations have been reduced. Additional monitoring and CIPP installation activities will be conducted in an iterative fashion, with new areas evaluated approximately every three months over the course of three years.

In addition to CIPP, several capital improvement projects (e.g., pump station improvements) are currently underway within the collection system. These projects will also be monitored to determine whether they result in reductions in dieldrin concentrations.

Treatment

If the "Prevention" approach is not successful in reducing dieldrin loadings sufficiently to provide compliance with the proposed dieldrin annual average WQBEL of 0.018 ug/L, additional treatment will be needed. A facility planning process for KRWWTP and associated sewer basin will be initiated around February 2020. This process will consider a wide range of issues affecting the service basin, including treatment alternatives to provide additional pollutant removal. While this facility planning is not specifically focused on dieldrin, the treatment alternatives under consideration may provide opportunity for additional dieldrin removal.

Upon completion of three years of CIPP installation and sewer system monitoring, data will be evaluated to determine whether prevention has reduced dieldrin sufficiently to meet effluent limits. If not, the treatment alternatives provided in the draft Facility Plan will be evaluated for their ability to reduce dieldrin to levels that meet proposed effluent limits. A treatment alternative will be selected and attained through a planning process (two years), design process (two years), and construction process (three years).

<u>Reporting</u>

Annual Reports will be submitted no later than March 31 of the following year (see Task (4)), with last report submitted on March 31, 2024 (see Task (5)). The Annual Report will summarize activities conducted during the year, provide all sampling results, and evaluate progress toward attaining effluent limitations.

v. Anti-backsliding. Anti-backsliding regulations are satisfied because the effluent limitations for dieldrin in the 2014 Permit were contested and stayed, and effluent limitations were not established in the Prior Permit. Therefore, these effluent limits are at least as stringent as the effluent limitations in the previous permit.

e. pH

The Permittee was previously granted a ZOM for pH to comply with WQS for open coastal waters at HAR, Section 11-54-6(b)(3). Receiving water data from March 2014 to July 2018 indicate compliance with the water quality objectives at the edge of the ZOM. The technology-based effluent limitations of between 6.0 to 9.0 standard units at all times appear to be protective of water quality outside of the ZOM and have been retained from the previous permit.

f. Enterococcus

The discharge consists of treated sewage which may contain pathogens at elevated concentrations, if not properly disinfected, sufficient to impact human health or the beneficial use of the receiving water. Due to determination of reasonable potential for the discharge to exceed the WQS, and to ensure the protection of human health, this permit establishes effluent limitations for enterococcus.

The discharge to the receiving water occurs approximately 3,500 feet from shore and 105 feet below the surface of the water and its use is not consistent with that at a bathing beach or used frequently during the recreation season. Immediate contact or use of the receiving water in the vicinity of the discharge is rarely expected to occur. The receiving water use is consistent with “infrequent use coastal recreation waters”, as defined at 40 CFR 131.41(a)(5).

On November 15, 2014, the State amended HAR, 11-54-8(b) to adopt new recreational water quality standards. The amended standards were approved by EPA on May 20, 2015. As amended, HAR, 11-54-8(b) establishes recreational criteria for all State waters designed to protect the public from exposure to harmful levels of pathogens while participating in water-contact activities. The specified recreational criteria for all State waters are: a geometric mean of 35 CFU/100 mL over any 30-day interval and a Statistical Threshold Value (STV) of 130 CFU/100 mL, which may not be exceeded in more than ten percent of samples taken within the same 30-day interval in which the geometric mean is calculated.

Receiving water data from March 2014 – December 2018 indicate that there were no exceedances of enterococcus at the edge of the mixing zone.

Illness from exposure to pathogens may occur at concentrations within the mixing zone, thus for the protection of human health due to the potential for acute illness from pathogens, the minimum initial dilution of 445:1 was used to calculate applicable single sample maximum WQBELs for enterococcus, and the average initial dilution was used to calculate the applicable monthly geometric mean WQBELs.

The draft permit establishes a final monthly geometric mean effluent limitation of 25,655 CFU/100 mL based on the enterococcus geometric mean of 35 CFU/100 mL and the average initial dilution at the ZID of 733:1. It also establishes a final single sample maximum effluent limitation, which may not be exceeded in more than ten percent of samples taken within the same 30-day interval in which the geometric mean was calculated, of 57,850 CFU/100 mL based on the STV of 130 mL and a minimum initial dilution at the ZID of 445:1.

Based on effluent data from March 2014 through December 2018, the MEC was 190,000 CFU/100 mL and the highest monthly geometric mean was 43,388 CFU/100 mL.

Anti-backsliding regulations are satisfied because the effluent limitations for enterococcus in the 2014 Permit were contested and stayed by the Hearings Officer, and the Prior Permit did not contain effluent limitations for enterococcus. Therefore, the limitations established in the draft permit are at least as stringent as the Prior Permit.

h. Whole Effluent Toxicity (WET)

WET limitations protect receiving water quality from the aggregated toxic effect of a mixture of pollutants in an effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent or receiving water. The WET approach allows for protection of the narrative criterion specified in HAR, Section 11-54-4(c)(2), while implementing Hawaii's numeric WQS for toxicity. There are two (2) types of WET tests – acute and chronic. An acute toxicity test is conducted over a short period of time and measures mortality. A chronic toxicity test is generally conducted over a longer period of time and may measure mortality, reproduction, or growth.

The 2014 Permit established a chronic WET effluent limitation at Outfall Serial No. 001 for *Tripneustes gratilla* ("*T. gratilla*").

In order to improve WET analysis, DOH implemented EPA's Test of Significant Toxicity Approach (TST) for WET effluent limitations within the State in the 2014 Permit. As such, the chronic WET effluent limitation at Outfall Serial No. 001 has been retained to be consistent with the TST approach using *T. gratilla*, a native species to Hawaii. WET data for the time period between March 2014 and December 2018 using the test species *T. gratilla* resulted in four exceedances of the chronic toxicity effluent limitation.

Test procedures for measuring toxicity to marine organisms of the Pacific Ocean, including *T. gratilla*, are not provided at 40 CFR 136. Consistent with the Preamble to EPA's 2002 Final WET Rule, test procedures that are not approved at 40 CFR 136 may be included in a permit on a permit-by-permit basis (under 40 CFR 122.41(j)(4) and 122.44(i)(iv)). The use of alternative methods for West coast facilities in Hawaii is further supported under 40 CFR 122.21(j)(5)(viii), which states, "West coast facilities in…, Hawaii,… are exempted from 40 CFR [P]art 136 chronic methods and must use alternative guidance as directed by the permitting authority."

EPA has issued applicable guidance for conducting chronic toxicity tests using *T. gratilla* in *Hawaiian Collector Urchin, Tripneustes gratilla (Hawa'e) Fertilization Test Method* (Adapted by Amy Wagner, EPA Region 9 Laboratory, Richmond, CA from a method developed by George Morrison, EPA, ORD Narragansett, RI and Diane Nacci, Science Applications International Corporation, ORD Narragansett, RI) (EPA/600/R-12/022).

As previously discussed, reasonable potential for WET has been determined for Outfall Serial No. 001 and an effluent limitation must be established in accordance with 40 CFR 122.44(d)(1). Further, a WET effluent limitation and monitoring are necessary to ensure compliance with applicable WQS in HAR, Section 11-54-4(b)(2).

The proposed WET limitation and monitoring requirements for a discharge which is submerged are incorporated into the draft permit in accordance with the EPA National Policy on Water Quality-Based Permit Limits for Toxic Pollutants issued on March 9, 1984 (49 FR 9016), HAR, 11-54-4(b)(2)(B), and EPA's *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010).

Consistent with HAR, 11-54-4(b)(2)(B), the draft permit retains the chronic toxicity effluent limitation based on the TST hypothesis testing approach. The TST approach was designed to statistically compare a test species response to the in-stream waste concentration (IWC) and a control.

For continuous discharges through submerged outfalls, HAR, 11-54-4(b)(4)(A) requires the no observed effect concentration (NOEC), expressed as a percent of effluent concentration, to not be less than 100 divided by the minimum dilution.

The 2017 Kailua Dilution Study minimum dilution of 445:1, used to determine an applicable IWC, is greater than the previous initial minimum dilution used to calculate the IWC, which was 185:1 (in 1985). The use of 445:1 dilution is based on the availability of new information contained within the Permittee's updated dilution study and is consistent with Section 402(o)(2) of the CWA's backsliding requirements. Further, the Permittee's historic effluent data indicates frequent occurrences of elevated levels of toxicity (with *T. gratilla*, justifying the need for greater dilution. Because the Permittee has historically exceeded WET standards using *T. gratilla*, an effluent limitation based on an IWC of 445:1 would not result in any additional pollutant loading of toxic substances greater than is currently being discharged.

The following equation is used to calculate the IWC where dilution is granted (Outfall Serial No. 001):

$$
\begin{aligned}
\text{IWC} &= 100/\text{critical dilution factor} \\
&= 100/445 \\
&= 0.22\%
\end{aligned}
$$

For any one chronic toxicity test, the chronic WET permit limit that must be met is rejection of the null hypothesis (Ho):

IWC (percent effluent) mean response ≤ 0.75 × Control mean response.

A test result that rejects this null hypothesis is reported as "Pass." A test result that does not reject this null hypothesis is reported as "Fail."

The acute and chronic biological effect levels (effect levels of 20% and 25%, respectively, or b values of 0.80 and 0.75, respectively) incorporated into the TST define EPA's unacceptable risks to aquatic organisms and substantially decrease the uncertainties associated with the results obtained from EPA's traditionally used statistical endpoints for WET. Furthermore, the TST reduces the need for multiple test concentrations which, in turn, reduces laboratory costs for dischargers while improving data interpretation. A significant improvement offered by the TST approach over traditional hypothesis testing is the inclusion of an acceptable false negative rate. While calculating a range of percent minimum significant differences (PMSDs) provides an indirect measure of power for the traditional hypothesis testing approach, setting appropriate levels for β and α using the TST approach establishes explicit test power and provides motivation to decrease within test variability which significantly reduces the risk of under reporting toxic events (U.S. EPA 2010[1]).

Taken together, these refinements simplify toxicity analyses, provide dischargers with the positive incentive to generate high quality data, and afford effective protection to aquatic life.

A WET effluent limitation based on the TST hypothesis testing approach is protective of the WQS for toxicity contained in HAR, Section 11-54-4(b)(4)(B) and is not considered to be less stringent. Use of the TST approach is consistent with the requirements of State and federal anti-backsliding regulations.

Effluent dilution water and control water shall be receiving water or lab water, as described in the test methods manual *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995). If the dilution water is different from test organism culture water, then a second control using culture water shall also be used.

Under the draft permit, the Permittee will be required to add two (2) additional test animals for WET testing (specifically, *Ceriodaphnia dubia* and *Atherinops*

[1] U.S. Environmental Protection Agency. 2010. *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document*. EPA 833-R-10-003. Washington, DC: Office of Wastewater Management.

affinis) to the current test species, *T. gratilla*. Accordingly, the Permittee shall conduct chronic toxicity testing on three species in accordance with appropriate test methods, rotating the test species month by month such that each test species is tested once every quarter.

i. Summary of Final Effluent Limitations

In addition to the effluent limitations specified above, HAR, Section 11-55-20 requires that daily quantitative limitations by weight be established where possible. Thus, in addition to concentration based-effluent limitations, mass-based effluent limitations (in pounds per day) have been established where applicable based on the following formula:

lbs/day = 8.34 * concentration (mg/L) * flow (MGD)

40 CFR 122.45(b)(1) requires that mass-based effluent limitations for POTWs be based on design flow. The Kailua Regional WWTP has a design flow of 15.25 MGD.

The following table lists final effluent limitations contained in the draft permit and compares them to effluent limitations contained in the previous permit.

Table F-7. Summary of Final Effluent Limitations – BOD and TSS

Parameter	Units	Effluent Limitations Contained in the 2014 Permit			Proposed Effluent Limitations[2]		
		Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily
Flow	MGD	[1]	[1]	[1]	[1]	[1]	[1]
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	mg/L	30	45	[2]	30	45	[2]
	lbs/day[2]	3,816	5,723	[2]	3,816	5,723	[2]
	% Removal	The average monthly percent removal shall not be less than 85 percent.			The average monthly percent removal shall not be less than 85 percent.		
Total Suspended Solids (TSS)	mg/L	30	45	[2]	30	45	[2]
	lbs/day[2]	3,816	5,723	[2]	3,816	5,723	[2]
	% Removal	The average monthly percent removal shall not be less than 85 percent.			The average monthly percent removal shall not be less than 85 percent.		

1 The Permittee shall monitor and report the results.
2 The Permittee shall monitor and report the analytical test results.
3 Based on a design flow of 15.25 MGD.

Table F-8. Summary of Final Effluent Limitations – All Other Pollutants

Parameter	Units	Effluent Limitations Contained in the 2014 Permit			Proposed Effluent Limitations		
		Average Annual	Average Monthly	Maximum Daily	Average Annual	Average Monthly	Maximum Daily
pH	standard units	Not less than 6.0 and not greater than 9.0			Not less than 6.0 and not greater than 9.0		
Chronic Toxicity – *Tripneustes Gratilla*[1]	Pass/Fail	--	--	Pass[2]	--	--	Pass[2]
Chronic Toxicity *Ceriodaphnia dubia*[1]	Pass/Fail	--	--	--	--	--	Pass[2]
Chronic Toxicity *Atherinops affinis*[1]	Pass/Fail	--	--	--	--	--	Pass[2]
Enterococci	CFU/100 mL	--	[4]	[4]	--	25,655[5]	57,850[6]
Dieldrin	µg/L	[4]	--	[4]	0.018	--	0.85
	lbs/day	--	--	[4]	0.0023	--	0.11
Ammonia Nitrogen	µg/L	--	[3]	[4]	--	--	--
	lbs/day	--	--	--	--	--	--
Nitrate + Nitrite Nitrogen	µg/L		[3]	[4]	--	--	--
Total Nitrogen	µg/L	--	--	[3]	--	--	--
	lbs/day	--	--	[3]	--	--	--
Total Phosphorus	µg/L	--	--	[3]	--	--	--
	lbs/day	--	--	[3]	--	--	--
Temperature	°C	--	--	[3]	--	--	--
Turbidity	NTU	--	--	[3]	--	--	[3]
Remaining Pollutants[8]	µg/L	--	--	[3]	[3]	[3]	--

1 The Permittee shall test one species of the three (3) chronic test species (*T. gratilla*, *C. dubia*, and *A. affinis*) each calendar month such that each species is tested at least once per quarter.
2 "Pass", as described in section D.2.h of this Fact Sheet.
3 The Permittee shall monitor and report the parameter analytical test results.
4 Effluent limitations in the 2014 Permit were challenged and stayed in the Contested Case Proceeding, and no limits were contained in the Prior Permit. *See* EPA's Interim Guidance on Implementation of Section 402(o) Anti-backsliding Rules for Water Quality-Based Permits.
5 Effluent limitation expressed as a monthly geometric mean.
6 Effluent limitation expressed as single sample maximum, which may not be exceeded in more than ten percent of samples taken within the same 30-day interval in which the geometric mean was calculated.
7 Effluent limitation expressed an annual geometric mean.
8 The Permittee shall perform semi-annual monitoring on all remaining pollutants listed in Appendix 1 of this permit, except those already specified in the table above. Effluent analyses for metals shall be reported as total recoverable.

j. Satisfaction of Anti-Backsliding Requirements

The CWA specifies that a revised permit may not include effluent limitations that are less stringent than the previous permit unless a less stringent limitation is justified based on exceptions to the anti-backsliding provisions contained in CWA Sections 402(o) or 303(d)(4), or, where applicable under 40 CFR 122.44(l).

The 2014 Permit effluent limitation for chronic toxicity has been retained in the draft permit. The IWC used to determine compliance with the effluent limitation is based on the minimum dilution. Since the minimum dilution has been increased based on new information contained in the Permittee's 2017 Dilution Study, the chronic toxicity effluent limitation of "Pass" is less stringent than the previous permit. This effluent limitation is based on new information and complies with anti-backsliding regulations.

The 2014 Permit effluent limitations for chlordane have not been retained due to results of the RPA. Data reported during the term of the 2014 Permit indicated that this parameter does not have reasonable potential to cause or contribute to exceedances of WQS. The removal of these effluent limitations is based on new information and complies with anti-backsliding regulations.

Additionally, for chlordane, dieldrin, ammonia nitrogen, nitrate plus nitrite nitrogen, and enterococcus effluent limitations, there is no backsliding because the limits in the 2014 Permit were contested and stayed by the Hearings Officer, and no limits were contained in the Prior Permit. *See* EPA's Interim Guidance on Implementation of Section 402(o) Anti-backsliding Rules for Water Quality-Based Permits.

k. Satisfaction of Antidegradation Requirements

The DOH established the State antidegradation policy in HAR, Section 11-54-1.1, which incorporates the federal antidegradation policy at 40 CFR 131.12. The State antidegradation policy requires, among other factors, that the existing quality of Tier 2 waters be maintained and protected unless the degradation is necessary to accommodate important economic or social development in the area in which the waters are located.

For chlordane, dieldrin, ammonia nitrogen, and enterococcus effluent limitations, antidegradation requirements are satisfied since there is no backsliding. The permit does not allow any alteration of the discharge and there is expected to be no degradation or lowering of water quality.

The permitted discharge is consistent with antidegradation provisions of 40 CFR 131.12 and HAR, Section 11-54-1.1. There are no adverse impacts anticipated that would lower the water quality and the level of water quality necessary to protect the existing uses should be maintained and protected.

E. Rationale for Receiving Water and Zone of Mixing Requirements

1. Summary of ZOM Water Quality Standards and Monitoring Data

The following are ZOM monitoring results for HAR, Chapter 11-54, specific water quality criteria parameters that were provided with the ZOM Application on August 10, 2018, and applicable ZOM water quality criteria from HAR, 11-54-6(b)(3).

Table F-9. ZOM Monitoring Data

Parameter	Units	Applicable Water Quality Standard	Maximum Reported Concentration[1]
Total Nitrogen	µg/L	110[2]	188
Ammonia Nitrogen	µg/L	2.0[2]	12
Nitrate + Nitrite	µg/L	3.5[2]	13
Total Phosphorus	µg/L	16[2]	11
Light Extinction Coefficient	k units	0.10	NR
Chlorophyll a	µg/L	0.15	0.81
Turbidity	NTU	0.20[2]	0.83
pH	standard units	[3]	8.1 to 8.4
Dissolved Oxygen	% saturation	[4]	6.6
Temperature	°C	[5]	28
Salinity	ppt	[6]	35

NR – Not Reported

1 Source: Data submitted with the ZOM Application dated August 10, 2018. Monitoring stations M2 through M5.
2 Water quality standards expressed as a geometric mean.
3 pH shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain, or groundwater discharge may depress the pH to a minimum level of 7.0.
4 Dissolved oxygen shall not be less than 75 percent saturation.
5 Temperature shall not vary more than 1° Celsius from ambient conditions.
6 Salinity shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

2. Existing Receiving Water Limitations and Monitoring Data

a. Shoreline Stations

The following are a summary of the geometric mean values calculated from each shoreline monitoring location, reported by the Permittee from March 2014 to May 2018.

Table F-10. Shoreline Monitoring Stations

Station	Geometric Mean[1]
	Enterococcus[2]
	CFU/100 mL
MS1	20
MS2	234
MS4	42
Kailua Beach	24
Kalama Beach	18
North Beach	14
Oneawa Beach	61
Applicable Water Quality Standard	35

[1] Source: Data submitted with the ZOM Application dated August 10, 2018.
[2] Water quality standards expressed as a geometric mean.

b. Offshore Stations

The following are a summary of the geometric mean values calculated from each offshore monitoring location on the edge of the ZOM, or reference station, reported in the monthly and quarterly DMRs from 2014 through 2018.

Table F-11. Offshore Monitoring Stations

Station[1]	Highest Annual Geometric Mean[1]						
	Enterococcus[2]	Nitrate + Nitrite Nitrogen[2]	Ammonia Nitrogen[2]	Total Nitrogen[2]	Total Phosphorus[2]	Turbidity[2]	Chlorophyll a[2]
	CFU/100 mL	µg/L	µg/L	µg/L	µg/L	NTU	µg/L
M1[3]	0.63	1.5[4]	2.4[4]	99	7.4	0.28	0.18
M2	0.74	2.3	2.9[4]	109	7.6	0.28	0.21
M3	0.69	1.4	3.5	104	7.3	0.23	0.19
M4	1.0	3.3	3.8[4]	103	8.3	0.23	0.18
M5	0.57	2.1	3.6[4]	101	7.8	0.25	0.26
M6[3]	0.81	1.4	3.3[4]	101	7.9	0.26	0.19
Applicable Water Quality Standard	35	3.5	2.0	110	16	0.20	0.16

[1] Source: Monthly and Quarterly DMRs submitted by the Permittee from 2014 through 2018.
[2] Reported geometric mean is the maximum annual geometric mean from the top, middle, and bottom sampling points at each station.
[3] Control station
[4] Negative values reported by the Permittee and were not considered in this calculation.

3. Proposed Receiving Water Limitations

a. The draft permit incorporates receiving water monitoring for future RPA and receiving water assessment. The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by DOH, as required by the Water Quality Act of 1987 (P.L. 100-4) and regulations adopted thereunder. The DOH adopted water quality standards specific for open coastal waters in HAR, Chapter 11-54.

b. The discharge from the facility shall not interfere with the attainment or maintenance of that water quality which assures protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife and allows recreational activities in and on the water. The draft permit incorporates receiving water monitoring for the protection of the beneficial uses of the Pacific Ocean.

c. The Permittee is required to comply with the HAR, Chapter 11-54, Basic Water Quality Criteria of which has been incorporated as part of the draft permit under Section 1 of the DOH Standard NPDES Permit Conditions.

4. Zone of Mixing (ZOM)

HAR, Chapter 11-54 allows for a ZOM, which is a limited area around outfalls to allow for initial dilution of waste discharges, if the ZOM is in compliance with requirements in HAR, Section 11-54-9(c). For the draft permit renewal, the Permittee requested that the existing ZOM for the assimilation of treated wastewater from the Pacific Ocean be retained. Consistent with the current permit, the ZOM requested is 1,000 feet wide and 1,960 feet along the centerline of the diffuser and extends vertically downward to the ocean floor. Figure 2 in the draft permit shows the ZOM.

a. Prior to the renewal of a ZOM, the environmental impacts, protected uses of the receiving water, existing natural conditions, character of the effluent, and adequacy of the design of the outfall must be considered. The following findings were considered:

   (1) The Permittee's ZOM application indicates that the existing physical environment is a marine bottom, class II reef flats. The ZOM application indicates that no major physical effects are expected due to the continuation of the ZOM.

   (2) The diffuser for Outfall Serial No. 001 reportedly provides a minimum of 445:1 dilution and discharges approximately 3,323 feet offshore.

No information provided in the ZOM application indicates that dilution would be negatively impacted by current conditions.

(3) The Permittee's ZOM application indicates that, based on monitoring data on the existing chemical environment, there seems to be no difference in water quality between the ZOM stations and control stations. Therefore, there appears to be no major environmental effects on the receiving water from the discharge.

(4) Effluent data and receiving water data are provided in Tables F-6, F-9, F-10, and F-11 of this Fact Sheet. Biological monitoring of the facility's diffusor found that no evidence of negative impacts to fish populations.

b. HAR, Section 11-54-9(c)(5) prohibits the establishment of a ZOM unless the application and supporting information clearly show: that the continuation of the ZOM is in the public interest; the discharge does not substantially endanger human health or safety; compliance with the WQS would produce serious hardships without equal or greater benefits to the public; and the discharge does not violate the basic standards applicable to all waters, will not unreasonably interfere with actual or probable use of water areas for which it is classified, and has received the best degree of treatment or control. The following findings were made in consideration of HAR, Section 11-54-9(c)(5):

(1) The facility treats domestic wastewater for approximately 94,000 people in the Ahuimanu, Kaneohe, and Kailua communities and is a necessity for public health. There are no other treatment facilities currently servicing this area and a cessation of function or operation would cause severe hardship to the residents.

(2) The level of treatment of the discharge and the depth and distance of the outfall offshore does not substantially endanger human health or safety. A review of the shoreline and offshore enterococcus bacteria data does not indicate a shoreward movement of the ocean outfall discharge.

(3) The feasibility and costs to install treatment necessary to meet applicable WQS end-of-pipe, or additional supporting information, were not provided by the Permittee to demonstrate potential hardships. However, based on effluent data, significant facility enhancements and capital costs would likely be necessary to comply with applicable WQS for which the ZOM was applied. As discussed in Part E.3.c.(2)(a), the operation of the facility has been found to benefit the public. No information is known that would

revise the finding during the previous permit term that compliance with the applicable WQS without a ZOM would produce serious hardships without equal or greater benefits to the public.

(4) As discussed in Part D.2.c.(5)(c) of this Fact Sheet, effluent data indicates the presence of pollutants with reasonable potential to exceed applicable WQS. However, this permit establishes WQBELs based on WQS. The draft permit requires compliance with the effluent limitations and conditions which are protective of the actual and probable uses of the receiving water and implement applicable technology-based effluent limitations.

The Department has determined that the ZOM satisfies the requirements in HAR, Section 11-54-09(c)(5).

Based on the finding that the ZOM satisfies the applicable requirements, pollutants for which a ZOM has been previously approved will retain the ZOM. These pollutants include total nitrogen, ammonia nitrogen, nitrate plus nitrite nitrogen, total phosphorus, chlorophyll a, pH, temperature, and salinity, light extinction coefficient, turbidity, and dissolved oxygen.

The establishment of the ZOM is subject to the conditions specified in Part D of the draft permit. The draft permit incorporates receiving water monitoring requirements which the DOH has determined are necessary to evaluate compliance of the Outfall Serial No. 001 discharges with the applicable water quality criteria, as described further in Section F.4 of this Fact Sheet.

F. Rationale for Monitoring and Reporting Requirements

40 CFR 122.41(j) specify monitoring requirements applicable to all NPDES permits. HAR, Section 11-55-28 establishes monitoring requirements applicable to NPDES permits within the State of Hawaii. 40 CFR 122.48 and HAR, Section 11-55-28 require that all NPDES permits specify requirements for recording and reporting monitoring results. The principal purposes of a monitoring program are to:

- Document compliance with waste discharge requirements and prohibitions established by the DOH;

- Facilitate self-policing by the Permittee in the prevention and abatement of pollution arising from waste discharge;

- Develop or assist in the development of limitations, discharge prohibitions, national standards of performance, pretreatment and toxicity standards, and other standards; and,

- Prepare water and wastewater quality inventories.

The draft permit establishes monitoring and reporting requirements to implement federal and State requirements. The following provides the rationale for the monitoring and reporting requirements contained in the draft permit.

1. Influent Monitoring

Influent monitoring is required to determine the effectiveness of pretreatment and non-industrial source control programs, to assess the performance of treatment facilities, and to evaluate compliance with effluent limitations. All influent monitoring requirements have been retained from the 2014 Permit. The influent water monitoring requirements are specified in Part A.1 of the draft permit.

2. Effluent Monitoring – Outfall Serial No. 001

The following monitoring requirements are applicable at Outfall Serial No. 001.

a. Monitoring requirements for ammonia nitrogen are retained from the 2014 Permit due to results of the RPA and to enable comparison with the receiving water ZOM monitoring results to determine if the facility effluent is contributing to elevated concentrations of said pollutant.

b. Monitoring requirements for total nitrogen, phosphorus, and turbidity have been removed due to results of the RPA that found no reasonable potential to exceed the WQS. Monitoring requirements for nitrate plus nitrite nitrogen have been removed from the draft permit. Nitrate plus nitrite nitrogen is constituent of the total nitrogen series. Since various forms of nitrogen change in the receiving water, total nitrogen is the most appropriate characterization of water quality. Therefore, nitrate plus nitrite nitrogen monitoring is no longer necessary.

c. Monitoring requirements for flow have been retained from the 2014 Permit to calculate pollutant loading and to determine compliance with mass-based effluent limitations.

d. Monitoring requirements for temperature have been removed due to results of the RPA and data over the previous term showing no reasonable potential to exceed to WQS.

e. Monitoring requirements for pH, BOD_5, TSS, and enterococcus have been retained from the 2014 Permit in order to determine compliance with effluent limitations and to collect data for future RPAs.

f. Monitoring requirements for total oil and grease have been retained from the 2014 Permit to ensure that the facility is meeting the basic water quality criteria contained in HAR, Section 11-54-4(a), which states all waters shall be free of “Floating debris, oil, grease, scum, or other floating materials,” and in the DOH’s Standard NPDES Permit Conditions.

g. Monitoring requirements for dieldrin have been increased from the 2014 Permit from annually to monthly due to results of the RPA and to determine compliance with newly established effluent limitations.

h. Monitoring requirements for all other pollutants listed in Appendix 1 of the draft permit are retained from the 2014 Permit in order to collect data for future RPAs.

3. Whole Effluent Toxicity Monitoring

Consistent with the 2014 Permit, monthly whole effluent toxicity testing is required for chronic toxicity in order to determine compliance with chronic toxicity effluent limitations as specified in Parts A.1 and B of the draft permit. Two additional species have been included for chronic toxicity monitoring, and the Permittee shall conduct chronic toxicity testing by rotating the test species month by month such that each test species is tested once every quarter.

4. Receiving Water Quality Monitoring Requirements

a. Shoreline Water Quality Monitoring

Shoreline water quality monitoring for enterococci is used to determine compliance with water quality criteria specific for marine recreational waters within 300 meters (1,000 feet) of shoreline, as described in Part C.1 of the draft permit. The Permittee shall monitor at seven stations with a frequency of five (5) days per month in order to calculate a geometric mean. These monitoring requirements are retained from the 2014 Permit and included in Part E.1 of the draft permit.

b. Offshore Water Quality Monitoring

Offshore water quality monitoring is required to determine compliance with State WQS, as described in Part D of the draft permit. The draft permit requires the Permittee to monitor offshore waters at four stations along the ZOM and two control stations outside the ZOM boundary. All monitoring requirements for offshore stations are retained from the 2014 Permit and included in Part E.4 of the draft permit.

c. Ocean Outfall Monitoring

At least once during the term of this permit, the Permittee shall inspect the ocean outfall and submit the investigation findings to the Director. The outfall inspection shall include, but not be limited to, an investigation of the structural integrity, operational status, and maintenance needs. The Permittee shall include findings of the inspection to the Director in the annual wastewater pollution prevention report in Part F of the draft permit for the year the outfall inspection is conducted. This requirement is retained from the previous permit.

G. Rationale for Provisions

1. Standard Provisions

The Permittee is required to comply with DOH Standard NPDES Permit Conditions, which are included as part of the draft permit.

2. Monitoring and Reporting Requirements

The Permittee shall comply with all monitoring and reporting requirements included in the draft permit and in the DOH Standard NPDES Permit Conditions.

3. Special Provisions

a. Reopener Provisions

The draft permit may be modified in accordance with the requirements set forth at 40 CFR 122 and 124, to include appropriate conditions or limitations based on newly available information, or to implement any new state water quality criteria that are approved by the EPA.

b. Special Studies and Additional Monitoring Requirements

(1) Toxicity Reduction Requirement. The draft permit requires the Permittee to submit an Initial Investigation Toxicity Reduction Evaluation (TRE) workplan to the Director and EPA which shall describe steps which the Permittee intends to follow in the event that toxicity is detected. This requirement is retained from the 2014 Permit and is discussed in detail in Part B.5 of the draft permit.

4. Special Provisions for Municipal Facilities

a. Pretreatment Requirements

The federal CWA Section 307(b), and federal regulations, 40 CFR 403, require POTWs to develop an acceptable industrial pretreatment program. A pretreatment program is required to prevent the introduction of pollutants, which will interfere with treatment plant operations or sludge disposal and prevent pass through of pollutants that exceed water quality objectives, standards or permit limitations. Pretreatment requirements are imposed in this permit pursuant to CWA Sections 307(b), (c), (d), and 402(b), 40 CFR 125, 40 CFR 403, and in HAR, Section 11-55-24.

The General Pretreatment Regulations require all large POTWs (those designed to treat flows of more than 5 million gallons per day) and smaller POTWs (that accept wastewater from industrial users (IUs) that could affect the treatment plant or its discharges) to establish local pretreatment programs. The General Pretreatment Regulations require the Permittee to control pollutants from the industrial users which may pass through or interfere with wastewater treatment processes or which may contaminate sewage sludge.

The draft permit includes a pretreatment program in accordance with the federal and State pretreatment regulations. The pretreatment requirements are based on the 2014 Permit and are consistent with NPDES permits issued to other Hawaii POTWs.

b. Biosolids Requirements

The use and disposal of biosolids is regulated under federal laws and regulations, including permitting requirements and technical standards included in 40 CFR 503, 257, and 258. The biosolids requirements in the draft permit are in accordance with 40 CFR 257, 258, and 503, are based on the 2014 Permit and are consistent with NPDES permits issued to other Hawaii POTWs.

5. Other Special Provisions

a. **Wastewater Pollution Prevention Program.** The draft permit requires the Permittee to submit a wastewater pollution control plan by May 31 each year. This provision is retained from the 2014 Permit and is required to allow DOH to ensure that the Permittee is operating the facility correctly and attaining maximum treatment of pollutants discharged by considering all aspects of the wastewater treatment system. This provision in included in Part F of the draft permit.

b. Wastewater treatment facilities subject to the draft permit shall be supervised and operated by persons possessing certificates of appropriate grade, as determined by the DOH. If such personnel are not available to staff the wastewater treatment facilities, a program to promote such certification shall be developed and enacted by the Permittee. This provision is included in the draft permit to assure that the facility is being operated correctly by personnel trained in proper operation and maintenance and is included in Part J.1 of the draft permit.

c. The Permittee shall maintain in good working order a sufficient alternate power source for operating the wastewater treatment and disposal facilities. This provision is retained from the 2014 Permit to ensure that if a power failure occurs, the facility is well equipped to maintain treatment operations until power resumes. If an alternate power source is not in existence, the draft permit requires the Permittee to halt, reduce, or otherwise control all discharges upon the reduction, loss, or failure of the primary source of power. This provision is included in Part J.2 of the draft permit.

H. Public Participation

A public notice of draft permit will be published in the Honolulu Star-Advertiser on January 20, 2020, soliciting public comment on the proposed action for a 30-day period. The permit application, applicable documents, draft permit and fact sheet will be available for public review at the CWB office. Persons wishing to comment upon or object to the proposed NPDES permit in accordance with HAR, 11-55-09(b) and 11-55-09(d), will have the opportunity to submit their comments in writing either in person or by mail, to:

Clean Water Branch
Environmental Management Division
2827 Waimano Home Road, Room 225
Pearl City, HI 96782

Appendix 1 Brown and Caldwell Kailua Dilution Study dated March 16, 2017

Brown and Caldwell

737 Bishop Street, Suite 3000
Honolulu, Hawaii 96813

T: 808.523.8499
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Technical Memorandum

Prepared for: City and County of Honolulu

Technical Memorandum

Subject: Kailua Regional Wastewater Treatment Plant (KRWWTP) Outfall Dilution Analysis and Assimilative Capacity Assessment

Date: March 16, 2017

To: Ross Tanimoto, P.E., Deputy Director
City and County of Honolulu, Department of Environmental Services

From: Peter Ono, P.E.

Copy to: Philip Roberts, Ph.D.

William K. Faisst, Ph.D., Brown and Caldwell

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Reviewed by: Peter R. Ono
Peter R. Ono, P.E.

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σ_t	one thousandth of a g/cc, or 1 kg/m^3
µg/L	microgram(s) per liter
%	percent
°C	degree(s) Celsius
CCH	City and County of Honolulu
cm	centimeter(s)
CTD	conductivity, temperature, and depth
DOH	State of Hawaii, Department of Health
erf	standard error function
ft	feet
km	kilometer(s)
m	meter(s)
mgd	million gallons per day
MLLW	mean lower low water
NPDES	National Pollutant Discharge Elimination System
ppt	part(s) per thousand
s	second(s)
TM	Technical Memorandum
WWTP	Wastewater Treatment Plant
ZID	zone of initial dilution
ZOM	zone of mixing

Section 1: Executive Summary

This Technical Memorandum (TM) presents results from dilution analyses and assimilative capacity evaluation for the Kailua Regional Wastewater Treatment Plant (KRWWTP) (NPDES Permit No. HI 0021296), carried out by Brown and Caldwell with assistance from Dr. Philip Roberts. Table ES-1 presents statistically-derived dilution estimates for the key permit-defined flow conditions.

Table ES -1. Predicted Dilutions

Description	Notes	Value
Minimum dilution at zone of initial dilution (ZID)	Ten percentile value of dilution at peak flow	445
Average dilution at ZID	Geometric mean dilution at design flow	733
Minimum dilution at zone of mixing (ZOM)-- including far field diffusion but no bacterial decay	Ten percentile value of dilution at peak flow	457
Average dilution at ZOM--including far field diffusion but no bacterial decay	Geometric mean dilution at design flow	742
Minimum dilution at ZOM, including bacterial decay	Ten percentile value of dilution at peak flow	490
Average dilution at ZOM, including bacterial decay	Geometric mean dilution at design flow	800

This study also evaluated whether assimilative capacity exists for nitrate-plus-nitrite nitrogen and ammonia-nitrogen by comparison of the 2012-2016 geometric mean concentrations at control stations (M1 and M6) to 90% of the corresponding water quality criteria. Based on this evaluation, we determined that assimilative capacity is available for both constituents.

Section 2: Introduction

At the direction of the City and County of Honolulu (CCH) Department of Environmental Services, Brown and Caldwell, with technical support from Dr. Philip Roberts, prepared this dilution study technical memorandum (TM) for the Kailua Regional Wastewater Treatment Plant (KRWWTP) (NPDES Permit No. HI 0021296) and the Mokapu Effluent Outfall. Discussion of dilution is followed by discussion of assimilative capacity below.

Section 3: Dilution Modeling Approach and Assumptions

This section presents dilution calculations as required for the NPDES permit for the City and County of Honolulu's KRWWTP and Mokapu outfall at Kailua, Hawaii. This TM presents modeling carried out using the most appropriate available data. We present dilution analyses for the zone of initial dilution (ZID), defined as where the near field mixing is completed and the zone of mixing (ZOM) defined as 500 feet (ft) from the diffuser. We completed numerical simulations using density stratification for five years, 2012 – 2016.

Figure 3-1 illustrates the basic processes under consideration schematically. A multiport diffuser ejects wastewater effluent horizontally as round turbulent jets. Because the density of treated domestic sewage is close to that of fresh water, it is very buoyant in seawater. The jets therefore begin rising toward the surface and may merge with adjacent jets as they rise. The turbulence and entrainment induced by the jets causes rapid mixing and dilution. The region in which this mixing occurs is called the "near field" or "initial mixing region." If the stratification is strong enough, oceanic density stratification may trap the rising plumes below the water surface; at that point they stop rising and begin to spread laterally. The effluent field then drifts with the ocean current; oceanic turbulence diffuses it and dilutes it further in a region called the "far field." The rate of mixing, or increase of dilution, occurs more slowly in the far field than in the near field. In addition, Enterococcus contained in the effluent die off due primarily to exposure to sunlight as the plume drifts in the far field.

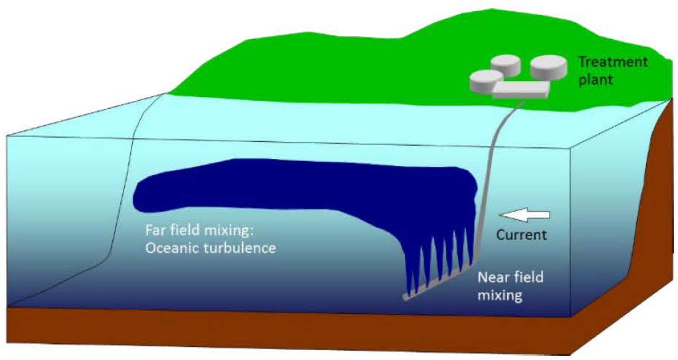


Figure 3-1. Typical behavior of wastewater discharged from an outfall into coastal waters

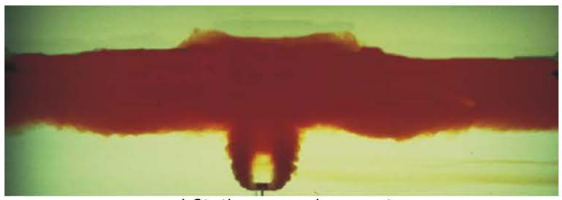
From Roberts et al. (2010).

Near-field mixing caused by the discharge buoyancy and momentum occurs over distances of 10 to 1,000 m and times of a few minutes. Far-field mixing, transport by ocean currents and diffusion by oceanic turbulence, occurs over distances of 10 m to 10 km and time scales of 1 to 20 hours.

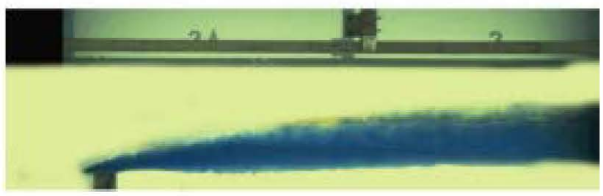
3.1 Near Field Model

For this study, we use NRFIELD, which is a part of the latest version of Visual Plumes. NRFIELD was specifically developed for effluent discharges into marine environments from multiport diffusers. It originally was based on the extensive experiments on multiport discharges into flowing density-stratified environments by Roberts, Snyder, and Baumgartner (1989abc), hence its original name of RSB. It has since been continually updated as reported by Tian et al. (2003, 2004) and others. Following the updates, and because it emphasizes the flow properties at the end of the near field, it was renamed NRFIELD. Since it was specifically designed for conditions typical of very buoyant discharges of domestic effluent from multiport diffusers into stratified oceanic waters, we selected NRFIELD as the most appropriate model for modeling discharges through the Mokapu outfall. NRFIELD also has been verified in field tests, for example Hunt et al. (2010); in field tests of the Hilo, Hawaii, outfall (Brown and Caldwell, 2005), NRFIELD gave dilution predictions that agreed well with field measurements. It accounts for discharges from both sides of the diffuser and varying current directions relative to the diffuser ranging from perpendicular to parallel. NRFIELD incorporates receiving water density stratifications and it includes the lateral spreading after the terminal rise height and subsequent turbulent collapse that occurs at the end of the near field.

Laboratory photographs presented in Figure 3-2 illustrate the essential physical processes modeled of a buoyant discharge from a multiport diffuser into stationary and flowing stratified environments. Buoyant effluents rise in the water column and are either trapped by the ambient density stratification if it is strong enough, or reach the water surface if it is weak. In a stationary environment (Figure 3-2a) the plumes reach a terminal rise height, collapse vertically, and then spread as a horizontal layer of some thickness. As the current speed increases (Figure 3-2b), dilution increases and the rise height and waste field thickness decrease. The distance to the end of the near field increases as the current speed increases. NRFIELD incorporates all these effects. Figure 3-2a illustrates the momentum overshoot of the plume before settling down to its final equilibrium level, sometimes referred to as the "second trap level." The State of Hawaii, Department of Health (DOH) guidelines specify that the second trap level be used in the ZID dilution calculations; NRFIELD automatically predicts dilutions at this level, which corresponds to the end of the near-field processes.



a) Stationary environment



b) Flowing current

Figure 3-2. Laboratory photographs of trapped buoyant plume from multiport diffuser in stationary and flowing stratified environments

From Roberts et al. (1989).

The primary outputs from NRFIELD are the dilution, the plume rise height, and wastefield thickness at the end of the near field as illustrated in Figure 3-3. The near field is defined as the region where mixing is caused by turbulence and other processes generated by the discharge itself, i.e. the buoyancy and momentum of the discharge (Roberts et al. 2010). For further discussion, see Doneker and Jirka (1999), and Roberts (1999). Thus, the definition of the near field is consistent with the definition of the ZID in the DOH Dilution Model Guidance that states: "Dilution at the ZID is the level of mixing when jet and buoyant mixing (nearfield processes) are complete." Following completion of the near-field processes, the plume drifts with the ocean current and is diffused by oceanic turbulence in the far field.

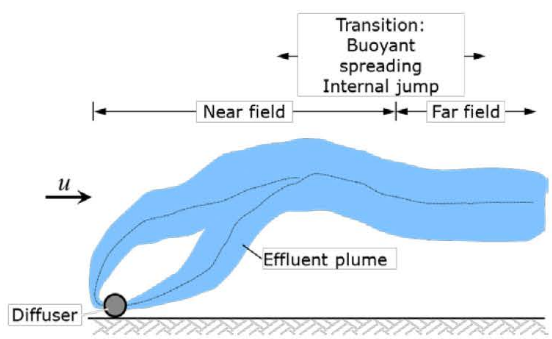


Figure 3-3. Trapped buoyant plume from multiport diffuser in stationary and flowing stratified environments

From Roberts et al. (1989).

3.2 Far Field Diffusion and Bacterial Decay

Per the permit, the distance of the ZOM from the diffuser is taken as 500 feet.

The far field diffusion from the ZID to the ZOM is modeled by Brooks (1959) solution to the diffusion equation assuming the 4/3 power law of diffusion:

$$\varepsilon = \alpha L^{4/3}$$

where ε is the initial value of the diffusion coefficient, α is a constant, and L is the diffuser length. The far field dilution S_f, is given by (Roberts, 1999a):

$$S_f = \left[erf\left(\frac{3/2}{\left(1+8\alpha L^{-2/3} t\right)^3 - 1} \right)^{1/2} \right]^{-1}$$

where t is the travel time from the diffuser to the ZOM and *erf* is the standard error function.

Fischer et al. (1979) quote values of α in the range of 0.002 to 0.01 cm$^{2/3}$/s. The higher values are appropriate for the early stages of diffusion beyond the near field so the value of α is taken to be 0.01 cm$^{2/3}$/s.

Bacterial decay is modeled as a first-order decay process:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}}$$

where c_o is the bacterial concentration after completion of near field mixing, c the bacterial concentration after travel time t and T_{90} is a decay rate expressed as the time for 90% reduction in bacteria due to mortality.

The decay rate depends on solar intensity and so is lower for a submerged field than for one at the surface. Measurements to simulate the decay of E. coli and Enterococcus at various levels of light intensity in Hawaiian waters were made by Landry et al. (1996). The decay rates of E. Coli and Enterococcus were similar and are discussed in Roberts (1999a). For near-surface light conditions, the average decay rate was T_{90} = 9.7 hours. The lowest light level tested was 3 percent of surface light intensity, for which the average decay rate was T_{90} = 24.1 hours. In the following we assume T_{90} = 9.7 hours for a surfacing effluent field and T_{90} = 24.1 hours for a submerged field.

The combined dilution due to far field mixing and bacterial decay is the product of the far field dilution S_f and the effective dilution due to decay, which is equal to c_o/c. The above equations show that both factors depend solely on the travel time from the ZID to the ZOM. They will be higher for slow current speeds and lower for high current speeds. The ZOM dilution results were weighted according to the frequency of current speeds and the dilution and plume submergence within each current speed range.

3.3 Outfall Description

Noda and Associates (1990) describes the Kailua outfall. The diffuser is located in a water depth of approximately 100 feet below mean lower low water (MLLW). The outfall pipeline extends 4,072 feet from the on-shore cleanout chamber to the start of the diffuser. The diffuser begins about 3,500 feet from shore. It consists of a 48-inch-diameter pipe with 80 ports along the pipe sidewalls and two ports in the end gate. The sidewall ports are spaced 12 feet apart in an alternating arrangement along opposite sides so the physical spacing on each side of the diffuser is 24 feet. The 82 ports consist of 30 4-inch diameter ports (these 30 ports are currently plugged); 20 4.5-inch diameter ports; 15 5-inch-diameter ports; 16 5.5-inch-diameter ports and a 4-inch-diameter half-round port at the bottom of the end gate. The diffuser length (first port to last port) is 960 feet. The smallest ports are closer to shore and port diameter increases with distance offshore.

Due to the varying port sizes and the actual number of open ports, for these analyses we used a diffuser configuration consisting of 52 open ports total with an equivalent port diameter of 5.00 inches. This approach maintains an equivalent port area, and therefore momentum flux of the discharge. The effective operating diffuser length end-to-end is therefore 612 feet. The port spacing for NRFIELD is taken as the actual port spacing, which is 24 feet on each side. The average depth of the open ports is assumed to be 105 feet below MLLW. Based on the record drawings of the Mokapu outfall, the orientation of the diffuser axis to East-West is taken as 21° counter-clockwise.

3.4 Oceanographic Data

Oceanographic measurements are taken from Noda (1990) which deployed five current meters at approximately mid-depth from September 30, 1989 to October 30, 1989. Table 3-1 presents a frequency distribution of current speeds at Station 1, closest to the diffuser. We used midpoint values for each speed range for the analyses.

Table 3-1. Frequency distribution of current speeds at Station 1 (Noda 1990)

Simulated speed (cm/s)	Speed range (cm/s)	Frequency of occurrence (%)
2.5	0-4.9	0
7.5	5-9.9	45
12.5	10-14.9	22
17.5	15-19.9	13
22.5	20-24.9	9
27.5	25-29.9	4
32.5	30-34.9	3
37.5	35-39.9	2
42.5	40-44.9	1
47.5	45-49.9	0
57.5	50-64.9	1
	Total	100

Review of Noda's data suggests that the flow consists of a mean geostrophic flow to the North with a tidal current superimposed. The vector mean drift at Station 1 is to the North (parallel to the local bathymetric contours) at about 7.5 centimeters per second (cm/s); the mean scalar speed is 14.1 cm/s. Peak speeds are about 60 cm/s; speeds are greater than 10 cm/s for about 55 percent of the time.

Noda also measured density stratification with conductivity, temperature and depth (CTD) casts on three days. The stratification was generally weak, with density differences over the diffuser depth ranging from about 0.04 to 0.51 σ_t (one σ_t is one thousandth of a g/cc, or 1 kg/m^3).

Since Noda's study was completed, CCH has collected quarterly CTD profiles near the diffuser at six locations beginning in January 1995, a total of about 530 profiles. Figure 3-4 shows the station locations. Figure 3-5 presents plots for all of the 120 profiles measured at stations M1 through M6 for the past five years (2012 to 2016).

Figure 3-4. Station locations for quarterly CCH density profiling

The quarterly profiles generally show weak stratification. Density differences over the water column down to the level of the diffuser range from zero (well mixed) to 0.84 σ_t. The 10-percentile density difference is 0.01 σ_t and the median density difference is 0.09 σ_t. The present dilution simulations used all profiles, from 2012 to 2016.

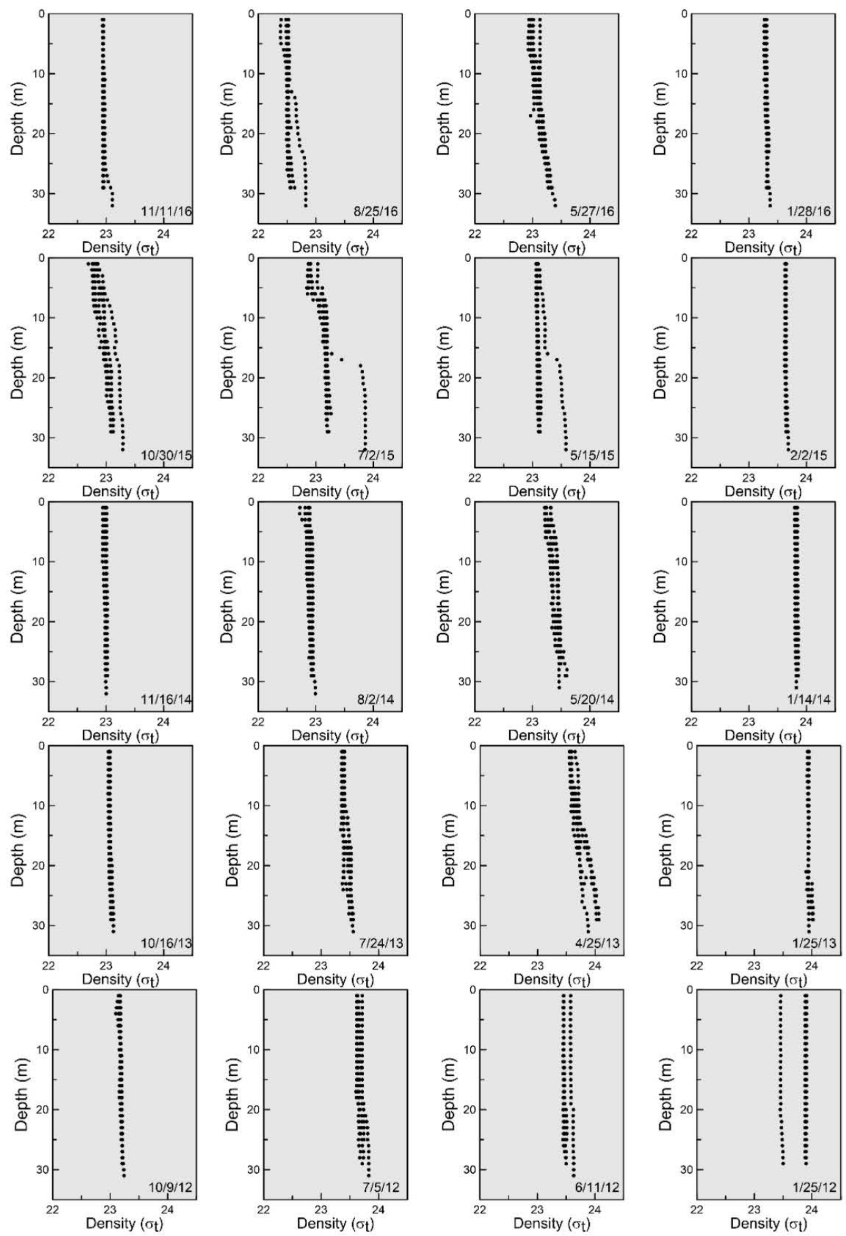


Figure 3-5. Quarterly density profiles measured at Kailua, 2012 -2016. Stations M1 through M6

3.5 Treatment Plant Flows

CCH staff measure and report flows hourly at the KRWWTP. Reported flow rates currently include flow from ongoing tunnel construction dewatering. We removed the tunnel flow since that input is transitory and will not occur after the contractor engaged by CCH completes tunnel construction.

After removing the tunnel construction dewatering flows, we compared the results to rainfall records for 2016 to investigate whether the spikes are due to wet weather. Stream gage data from the Haiku Valley near Kaneohe were used as a proxy for rainfall. Figure 3-6 shows the results.

It is apparent that the large KRWWTP flow spikes correspond to large stream flows and are wet weather events. Further, the period January through March 2016 has no significant wet weather events and is considered representative of dry weather flows from the KRWWTP. To obtain the peak 3-hour flow rate, a moving average was applied to the data for January – March 2016 and the highest value extracted. Since CCH projects that the area tributary to the KRWWTP will experience very little growth in the next five years, our analyses assumed that the 2021 flows would match those measured for 2016. Table 3-2 reports the flow rates used for this study.

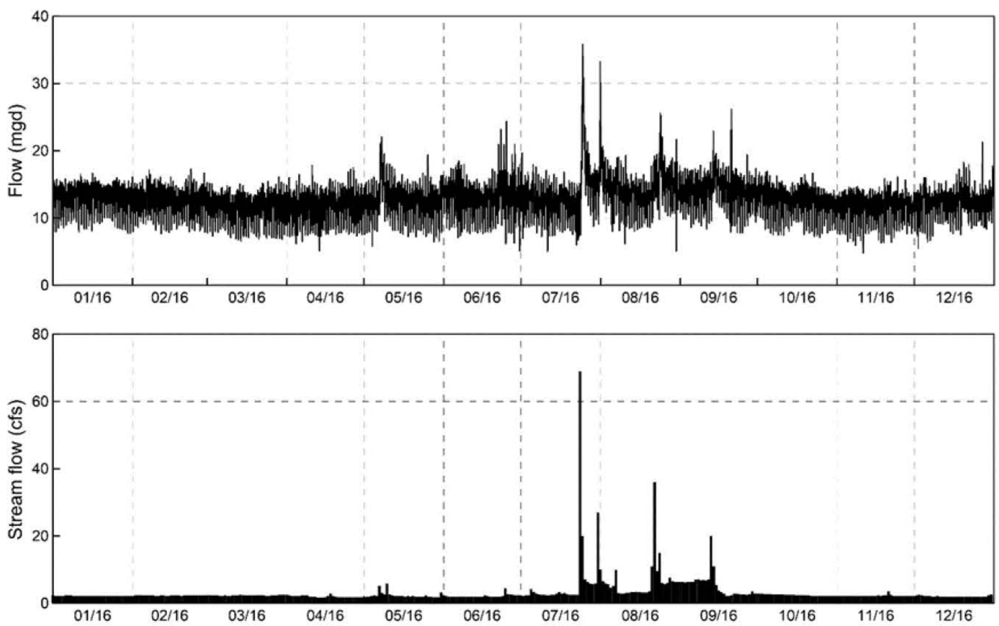


Figure 3-6. KRWWTP hourly treatment plant flows 2016 and daily stream gage data in Haiku Valley

Table 3-2. KRWWTP Dry Weather Flow Characteristics	
Parameter	Flow (mgd)
Average	12.1
3-hour peak	15.7
Design	15.25

3.6 Effluent Density

The effluent density, in particular, the difference in density between the effluent and the receiving waters, affects dilution; the dilution decreases as the effluent density increases. For analyses presented in this TM we obtained hourly effluent temperature and salinity data. For minimum dilutions, we assumed that the effluent temperature was the 10th percentile value (28.04°C) and effluent salinity was the 90th percentile value (6.9 ppt) for a computed effluent density of 1.4 σ_t. For average dilutions, we assumed average values of temperature (28.33°C) and salinity (6.6 ppt) for a computed effluent density of 1.1 σ_t.

Section 4: Dilution Simulations

4.1 Definitions of Dilution

We adopted the following dilution definitions for this TM:

- **Minimum Dilution at ZID (Critical dilution):** Ten percentile value of the dilutions computed at the projected 3-hour peak flow rate.
- **Average Dilution at ZID:** Geometric mean of the dilutions computed at the design flow rate.
- **Minimum dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion but no bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion but no bacterial decay.
- **Minimum dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion and bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion and bacterial decay.

4.2 Results

We ran NRFIELD for all the 120 density profiles shown in Figure 3-4 for the design and peak flows in Table 3-2 and the mid-current speed in each of the frequency bins in Table 3-1, a total of 2160 runs. The dilution results at the ZID were weighted according to the current speed distribution in order to account for the effect of currents on dilution and plume rise height. The dilution results at the ZOM were weighted according to the current speed distribution and also the far field diffusion and bacterial decay in each current speed range. Table 4-1 summarizes the results.

Table 4-1. Predicted Dilutions		
Description	Notes	Value
Minimum dilution at ZID	Ten percentile value of dilution at peak flow	445
Average dilution at ZID	Geometric mean dilution at design flow	733
Minimum dilution at ZOM including far field diffusion but no bacterial decay	Ten percentile value of dilution at peak flow	457
Average dilution at ZOM including far field diffusion but no bacterial decay	Geometric mean dilution at design flow	742
Minimum dilution at ZOM, including far field diffusion and bacterial decay	Ten percentile value of dilution at peak flow	490
Average dilution at ZOM, including far field diffusion and bacterial decay	Geometric mean dilution at design flow	800

Section 5: Assimilative Capacity

As required by the Kailua KRWWTP NPDES permit, this TM presents an evaluation of the assimilative capacity assessment for nitrate-plus-nitrite nitrogen and ammonia nitrogen. Assimilative capacity is the amount of constituent loading that a water body can receive without violation of water quality standards. Assimilative capacity is assessed by evaluating the background water quality; i.e., the chemical characteristics of the water with which a discharge will mix. For this evaluation, the assimilative capacity was evaluated by computation of the geometric mean of nitrate-plus-nitrite nitrogen and ammonia nitrogen concentrations at control stations M1 and M6 over 2012-2016. Assimilative capacity was determined to exist if the resulting values were equal to or less than 90% of the corresponding water quality criteria.

Censored values (values at or below the detection limit) were set to half the detection limit. We aggregated data from both stations (M1 and M6), all depths, and all years for calculation of the concentration statistics. This approach is consistent with Hawaii's water quality standards, which were derived as the statistical properties of multi-year monitoring datasets and represent the properties of "areas judged to be in a generally desirable condition" (DOH, 1977) rather than thresholds of deleterious effects over specific averaging periods. The aggregation of data from multiple years also is consistent with Hawaii's approach for water quality assessment (DOH, 2014).

Table 5-1 presents results of the assimilative capacity evaluation. The geometric mean concentrations of both nitrate-plus-nitrite nitrogen and ammonia nitrogen were less than 90% of the respective criteria. Based on these results, assimilative capacity exists for both constituents.

Table 5-1. Geometric Mean Concentrations at Control Stations M1 and M6, 2012-2016				
Parameter	Geometric Mean Criterion (µg/L)	90% of Geometric Mean Criterion (µg/L)	Geometric Mean at Stations M1+M6 µg/L)	Exceeds 90% of Criteria?
NO23-N	3.50	3.15	0.85	No
NH4-N	2.00	1.80	1.57	No

References

Brooks, N. H. (1959). “Diffusion of Sewage Effluent in an Ocean Current.” Proc., First International Conference on Waste Disposal in the Marine Environment, Pergamon Press, New York, 246-267. July 22-25, 1959.

Brown and Caldwell (2005). “Hilo Bay Mixing Zone Study. County.” Prepared by Brown and Caldwell, Honolulu, Hawaii, July 2005.

Doneker, R. L., and Jirka, G. H. (1999). “Discussion of mixing of inclined dense jets” by Roberts, P. J. W., Ferrier, A., and Daviero, G.” (1997).” J. Hydraul. Eng., 125(3), 317–319.

Edward K. Noda and Associates, Inc. (1990). “Preliminary Engineering Report, Mokapu Ocean Outfall, Mokapu Peninsula, Oahu.” Prepared for Division of Wastewater Management, Department of Public Works, City and County of Honolulu, Honolulu, Hawaii. March 1990.

Fischer, H. B., List, E. J., Koh, R. C. Y., Imberger, J., and Brooks, N. H. (1979). Mixing in Inland and Coastal Waters, Academic Press, New York.

Hawaii Department of Health (1977). An Ecosystem Approach to Water Quality Standards. Report of the Technical Committee on Water Quality Standards.

Hawaii Department of Health (January 16, 2014). Fact Sheet: APPLICATION FOR RENEWAL OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND ZONE OF MIXING (ZOM) TO DISCHARGE TO THE PACIFIC OCEAN, WATERS OF THE UNITED STATES. (NPDES PERMIT NO. HI 0021296).

Hunt, C. D., Mansfield, A. D., Mickelson, M. J., Albro, C. S., Geyer, W. R., and Roberts, P. J. W. (2010). “Plume tracking and dilution of effluent from the Boston sewage outfall.” Marine Environmental Research, 10.1016/j.marenvres.2010.04.005, 70(2), 150-161.

Landry, M. R., Campbell, L., and Dobbs, F. C. (1996). “Microbial Aspects of Point and Non-Point Source Pollution in Mamala Bay: Bather and Light Effects on Sewage-Indicator Bacteria.” Mamala Bay Study Commission, Project MB-7, April 1996.

Roberts, P. J. W., Snyder, W. H., and Baumgartner, D. J. (1989). “Ocean Outfalls. I: Submerged Wastefield Formation.” J. Hydraul. Eng., 115(1), 1-25.

Roberts, P. J. W. (1999a). “Modeling the Mamala Bay Plumes. II: Far Field.” J. Hydraul. Eng., 125(6), 574-583.

Roberts, P.J.W. (1999b). “Closure to Discussion of mixing of inclined dense jets’ by Roberts, P. J. W., Ferrier, A., and Daviero, G.” (1997).” J. Hydraul. Eng., 125(3), 317–319.

Roberts, P. J. W., Salas, H. J., Reiff, F. M., Libhaber, M., Labbe, A., and Thomson, J. C. (2010). “Marine Wastewater Outfalls and Treatment Systems.” International Water Association, London.

Tian, X., and Roberts, P. J. W. (2003). “A 3D LIF System for Turbulent Buoyant Jet Flows.” Expts. Fluids, 35, 636-647.

Tian, X., Roberts, P. J. W., and Daviero, G. J. (2004). “Marine Wastewater Discharges from Multiport Diffusers I: Unstratified Stationary Water.” J. Hydraul. Eng., 130(12), 1137-1146.